GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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Editorial Notes.

Combustion and Flue Equipment.

THERE is no more important problem affecting the satisfactory functioning of gas and coke appliances than that of ventilation; and we suggest that the intricate complexity of this problem, and failure to appreciate its significance have hitherto retarded even its partial solution. For some time now work of first-rate importance on the question has been in progress at Watson House; empirical ideas have been cast aside, and the matter has been attacked fundamentally and courageously. Last week Mr. C. A. Masterman presented many of the results of this investigation to the Institution of Heating and Ventilating Engineers; and we have pleasure in commencing publication of these results in to-day's "JOURNAL."

Of course, Mr. Masterman's paper is by no means the be all and end all of the ventilation problem, but, as far as we are aware, it affords the first reasoned expression for determining, for a flue of given area or diameter, the critical height at which the products of combustion will be completely removed and sufficient draught provided to meet combustion requirements in all normal circumstances. It is not our intention here to review the paper, but there are a few considerations of a general character which ought to be more widely known. One of the most significant aspects of gaseous combustion as distinct from the burning of solid fuel is that with gas appliances a baffler may be employed which renders the apparatus in essence independent of variations in chimney pull (or "push," as some would have it) and permits of relatively very high thermal efficiencies. Far from being an annoying encumbrance, a baffler is a desirable adjunct to high-efficiency gas consuming appliances; but it is essential that the baffler used should be correct in principle and in application. And in regard to the design of bafflers, Watson House has done some very valuable work. The subject is discussed at length by Mr. Masterman, and readers must gain added conviction that gas is a refined fuel.

Very important are the author's observations on induced downdraught, and his remarks on the subject of condensation in flue equipment ought to be studied with care. We are all aware that flue products deposit water when their temperature is below a certain critical point depending on the content of water vapour present. The trouble is that we do not pay sufficient attention to the variations in temperature at different points of the cross-section of the flue. Measurement of the mean flue gas temperature affords no clue as to when condensation will occur, owing to the high temperature gradient across the flue. Even in so-called turbulent flow, an inner core of ascending hot gases is surrounded by an outer core of comparatively cold gas; and it is the temperature of the flue surface which determines whether or not there shall be condensation. This leads Mr. Masterman to suggest that, if condensation is threatened, the risk may be greatly diminished if a long straight run is broken by elbows or bends which cause the hot gas core to mingle with the cooler gas shell, and so re-establish the mean temperature across the moving mass. It is perhaps unnecessary for us to call attention to the virtues of asbestos cement for flue pipes.

There are many other questions dealt with by Mr. Masterman on which we could remark, but we think that, in view of the precise nature of the paper, no good purpose could be served by doing so. Suffice it to say that this pioneer contribution to our knowledge of the subject is wholly deserving of the closest application.

The Gas Industry and the Coal Bill.

THE case for the gas industry against the Coal Mines Bill is admirably summarized in a speech which Sir David Milne-Watson delivered at a National Gas Council lunch yesterday, and which is fully reported in a later column. It is so clearly stated as to leave no room for comment; it is so strong that it is difficult to see in what way it can be disputed. Unfortunately, as we have previously remarked, all arguments either economic or ethical are in danger of being ruthlessly swept aside in this instance at the dictates of political necessities. The Government's pledge to reduce working hours in the mines is, if they can possibly force it through, to be redeemed at the price of increasing the cost of living to the nation and the cost of production of British-made goods, with a cheapening of production costs for foreign manufacturers who already compete with us far too successfully.

One of the inequities of the proposals stressed by Sir David is the differentiation between different classes of coal consumers which the owners will be able to make. While they are nominally the controllers of the scheme, all selling plans are subject to approval by officialdom—and the gas industry has learned by now what kind of treatment to expect from this quarter, especially in comparison with its principal competitor, electricity. And while electricity is the darling of officialdom, it is reasonable to suppose that what is known as the household coal trade will be duly nursed by the collieries under the new conditions, as it is much more nearly allied to them than the gas industry.

We, as an industry, can congratulate ourselves upon the firm stand our leaders are taking against the Bill, and must give them every possible support in their contention that, if it has to go through in some shape or form, it must be radically altered. It is, in itself, not only uneconomic in detail, but hopelessly unpatriotic as well. When, in addition, it threatens the prosperity of our industry, which we know is vital to the well being of the nation, it is time we roused ourselves to the full.

A Reassuring Sign.

SOME of the more spectacular of the financial collapses during 1929 have received so much attention in the pages of the newspaper Press that everyone has become aware that large losses have fallen upon investors and speculators. The full extent of these losses cannot, however, yet be stated, as smaller, though serious, disasters continue to follow each other with disturbing frequency. So many of these financial proposals are seen to possess vital defects when exposed to the test of official investigation, that investors must be wondering whether they have been enjoying all the safeguards that could be vouchsafed them. We have not thought so; and we have not hesitated to express that view. Obviously the monetary losses of last year would have assumed less staggering proportions had every offer of shares been subjected to expert criticism; but the investing public, as a whole, is not expert, and developments of recent years have tended to make that even truer than was the case formerly.

It is just because of this that we are anxious to see the investor, be he speculative or otherwise, surrounded by such safeguards as may be practicable. Even so, he will remain at a disadvantage, because, as has been shown in numerous instances recently, the conditions on the faith of which he may have put up his money can be altered without knowledge of such alteration being immediately conveyed to him. He may subscribe for shares on the faith of the front page of the prospectus; he may do so on the strength of the assurance that "the whole issue has been underwritten." The Board may change; the underwriters may be unable to fulfil their obligations. Other equally disquieting possibilities will occur to anyone who has had experience of such matters; and therefore we do feel that all practicable steps should be taken to protect the investor. Such a policy must prove beneficial all round—to the financier not less than to others.

While thus referring to the soundness of this policy of protecting the investor, we would like to draw attention to an announcement that the London Stock Exchange Committee have prohibited the marking of bargains in the shares of two undertakings which have previously been quoted in the Supplementary List. Similar action has been taken in Glasgow. No reason has been given for so doing, but recently a "certain liveliness" has been witnessed in both shares. The decision does not prevent dealings in them; but the publicity which these dealings have hitherto enjoyed will be absent. Knowing nothing of the circumstances of this particular case, we can express no opinion on it. We note, however, a statement in a financial contemporary that the action of the Committee has nothing to do with the Companies themselves. Our own interest is in the indication which the step affords of the policy of the Stock Exchange Committee. Any move made in the interests of the public must be all to the good.

A Carbonizer's Pilgrimage.

THE title of Mr. H. J. Toogood's paper before the Scottish Juniors—see later pages—is really so apt that we repeat it here. Twenty-six years of practical carbonizing—it was in 1904 that the author first became associated with the firm of Robert Dempster & Sons, Ltd., of Elland—have borne good fruit, as those acquainted with Dempster-Toogood settings are well aware; and Mr. Toogood's story of the carbonizing developments in which he has had so prominent a part makes fascinating reading.

The paper is really divided into two parts; in the first the evolution of the vertical retort at Elland is outlined, and this is followed by an epitome, complete with reasons, of progress in the design of horizontal settings in the same town. We may with advantage call attention to one or two striking points in these sections. Regarding continuous verticals, the author indicates that the idea of discharging cool coke owes its origin not to choice or design, but to necessity—to the fact that the extracting mechanism could not deal with incandescent coke; and he mentions that in the pioneer plant at Hebden Bridge, coke was discharged direct from the retorts into consumers' carts. Such an arrangement, of course, may have some spectacular appeal, but we should not care to see it practised to-day, when, rightly, great store is set by screening coke, and applying the appropriate grades to definite purposes.

Having advanced the argument—with which it is, however, somewhat difficult to agree—that the success of vertical retorting actually rehabilitated the horizontal retort, the author certainly puts forward a convincing case for the modern horizontal setting. One is apt, perhaps, to lose sight of the remarkable improvements which have been effected in horizontals since the war; and Mr. Toogood's paper is an admirable antidote to forgetfulness in this direction. As many of our readers may be aware, he considers that the main arch of a horizontal setting is no longer necessary. He suggests that it is better to substitute a flat dead-weight bench cover, and adduces the following reasons for this: Increased efficiency; economy in construction of the setting; reduced costs of ironwork; absorption of the expansion of silica; and the fact that each setting can be independent of its neighbours. Conversion of existing settings from the main arch to the flat cover, we understand, can be carried out cheaply and without difficulty.

The virtues of descension pipes, and screen-bar grates for producers, are set out, and the author has some interesting observations on heat losses from bench brickwork, though his remarks on this matter would have been much clearer if he had differentiated between the loss due to radiation and that due to convection. Finally, we would call attention to his reference to a new method of retort governing which he has developed. This consists of a cheap form of float-control of a liquor seal valve, the relay being derived from the usual (but augmented) liquor dribble. This device was described and illustrated in the "JOURNAL" last year (June 12, p. 811); and we understand that the theory is shortly to be put to practical proof. If it is successful, we shall, to quote Mr. Toogood's own words, be one step nearer the carbonizer's ideal—level-gauge at all times for every retort.

Ash and Ashes.

THE vision of clean coal has been before our industry for a long time, but, though certain headway in the right direction has been made, the fact remains that unnecessarily dirty coal is to-day being transported to gas-works, and handled and carbonized, and its dirt content finally carted away from domestic dustbins. Recently, Mr. W. E. Plevin ("JOURNAL" for Dec. 4, 1929) demonstrated that all is not dirt which looks so, and that some fraction yields therms of gas which are eventually sold to the public. However, he did not mention the cost of producing the gaseous therm from dirt; and we ventured to suggest that its presence in a gas retort is an anachronism.

If any of our readers wish to know what dirt in coal means, they will find the information in a lecture by Dr. R. Lessing published in this issue. There is need to differentiate between ash which can be removed, and that which is inherent in the true coal substance; and, says Dr. Lessing, there is hardly any British coal having more than 3 or 3½ p.ct. of ash in the true coal substance, while the vast majority range from 1 to 2½ p.ct. It should be the aim, therefore, to get down to the inherent ash content; and how this can be done is explained by the author of the contribution to which we refer. He describes a large-scale plant in South Wales which, he claims, works the oracle in an economical manner; the coal treated emerging from the plant with an ash content not greater than 2 p.ct.

Clean coal must obviously cost more than dirty coal, but we believe that, if the advantages which would accrue to the gas industry by the carbonization of clean coal were assessed monetarily and with an eye to the future, the extra cost would be well worth while. If coke contained only 5 p.ct. of ash, we feel sure that the domestic demands alone would exceed available supplies. Coke in the open firegrate would be a revelation to the householder, and absence of clinker troubles and ash disposal in the hot water boiler would transform an indifferent consumer into an enthusiastic user likely to pay a little more for such a

satisfactory fuel. It is realized, of course, that at present gas undertakings are paying for dirt in the coal they carbonize, and are paid still more highly for the dirt which is sold in coke; and it may be argued that, to supply present coke demands, much more clean coal would be required.

In this respect, however, many considerations must be borne in mind: To produce a given thermal yield, less coal would be required; to produce a greater thermal yield, extra retorting plant would become unnecessary up to a point; the carbonizing plant would become more effective automatically, capital costs per therm being reduced in two ways (by greater throughput and by longer life of settings); fuel costs per therm of gas would be lowered; the cost of the producer gas therm would be less, and the working of the plant would be more regular, and would require less labour; and, finally, the coke produced would contain less breeze, and, being more effective as a heating agent, would reduce the amount necessary to carry out a definite operation. In regard to the last-named consideration, the first effect might be a lowering of tonnage demand; but we are convinced that the reduction would be momentary, for there can be no doubt that a 4 p.ct. ash coke would quickly transform the current sales situation.

We must mention the effect of clean coal on water gas manufacture, and hence on the final cost of the "mixed therm." The difficulty in water gas making to-day is the irregularity of quality due to the changes in the clinker bed. True, mechanically-operated plant has done much to improve matters; but there are still many hand-worked units in which the losses through clinkering, and re-heating after clinkering, cost much money. Again, apart from the quality of the gas, a 4 p.ct. ash coke implies greater capacity of the set, longer life of linings, and reduced labour or power. There is a further by no means theoretical advantage of clean coal and clean coke for gas manufacture—the fact that the sulphur would be reduced from 2 p.ct. to 1 p.ct. and under in the clean coal, and, therefore, the work of the purifying system would be lightened. There is surely the strongest of all possible cases for clean coal.

British Industries Fair.

A reminder of the active preparations which are now being made for the 1930 British Industries Fair, Birmingham Section, has been received in the form of an advance catalogue. The Birmingham Chamber of Commerce (Inc.), who organize this Section, state that advance catalogues have been despatched to 10,000 prospective buyers in the heavy trades, resident in all parts of the world.

The Road was Badly Lighted.

In last week's issue, we quoted statements made at three inquests in connection with motor fatalities, to the effect that the thoroughfares in which the accidents occurred were imperfectly lighted. Another inquest of a like character has since been reported, at which a police inspector declared that the road was badly lighted. This street lighting question calls urgently for attention. The spending authorities should not wait until definite standards are forced upon them by the Legislature.

You Can Do It Better with Gas.

In one of the most recent issues of the "Nation and Athenæum" we were interested to see an article by Mr. Henry A. Mess, on "The Dustbin and Afterwards." The title was a promising one, and we quite expected an indication of the lines on which so many people have solved the problem of domestic refuse. It would have been valuable; for the author states that "many a village has an unsightly and an unhealthy heap on the banks of its stream or spoiling the beauty of a corner of its wood," while "the Hornchurch dumps, which have been built up by the dustbins of London, are three-quarters of a mile long, a third of a mile wide, ninety feet high, and still growing." This would be a dark picture were no remedy at hand. The remedy is, however, pointed out in the article—the householder should burn more rubbish. The open grate is inconvenient for the purpose; but there is a better way, and the author is quite wrong in saying, after admitting that gas is being increasingly used for heating and cooking, that it must be set down as a disadvantage against its many advantages that "it offers no provision for destroying refuse." On the contrary, the gas incinerator, which is ever growing in popularity, is an exceedingly simple, expeditious, and efficient method of consuming household waste. It has an enormous field of usefulness, and merits universal recognition.

Coke is Also Efficient.

Another simple means of disposing of household refuse is in the coke boiler, now so extensively used for domestic hot water supplies. These boilers will rapidly consume anything but metal or glass, which can go to the dustbin along with the ash remaining after the incineration of the rubbish. No one who has had experience of a dustbin containing only such material would be willing to go back to the bad old insanitary system. Should the destruction of household refuse be enforced by law (and we should welcome such an enactment) the gas incinerator and the coke boiler would alternatively provide means of which all could avail themselves. Is this a field which our electrical friends could successfully cultivate?

Prevention or Remedy?

In the matter of fogs, as with other things, we hold that prevention is better than cure; and we therefore urge the general use of smokeless fuel. If, however, fogs must be, a "disperser" will doubtless have its uses; and the "Electrical Review" reports that a device intended to disperse fog sufficiently to enable vehicle drivers to see their way for some distance ahead is being developed. The idea was suggested by the fact that when a brazier is lighted during foggy weather an area of clear air surrounds the fire, caused by the drying of the atmosphere. The "Fog-gon" operates on the same principle. It emits a stream of hot air before the vehicle to which it is fitted, and a lamp may be so incorporated as to intensify the clear-air beam. The heat is produced electrically, and the air stream by a motor driven fan.

Forthcoming Engagements.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Jan. 16.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council meeting in the afternoon.

Jan. 18.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Bradford. Paper by Dr. J. A. Sugden (Leeds University) on "Refractories."

Jan. 22.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual meeting of members in the Northern District, Gas Offices, Grainger Street West, Newcastle, 3.45 p.m.

Jan. 24.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual meeting of members in Scotland, North British Station Hotel, Glasgow, 2.15 p.m.

Jan. 25.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Meeting in Glasgow. Paper by Mr. Alex. Tran, of Helensburgh, "Some Notes on Ferro-Concrete." Also, Mr. A. McFarlane will read his Thesis which gained the Diploma of the Institution of Gas Engineers.

Jan. 30.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in Birmingham. Paper by Mr. C. Featherstone Hammond, of Messrs. Submerged Combustion, Ltd., on "Submerged Combustion."

Jan. 31.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute. Paper by Mr. G. Percival on "Horizontal Retorts."

Feb. 10.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Annual dinner and dance.

Feb. 11.—FEDERATION OF GAS EMPLOYERS.—Quarterly meeting of Central Committee, 28, Grosvenor Gardens, S.W. 1.

Feb. 11.—NATIONAL GAS COUNCIL.—Meeting of Central Executive Board.

Visit to the Colombo Gas-Works.—The Secretary of the Colombo Gas and Water Company, Ltd., asks us to state that the article which appeared on p. 85 of last week's "JOURNAL" was published without having been first submitted to the Company for verification and approval.

How the Coal Mines Bill Will Affect the Gas Industry and Its Consumers.

Speech Delivered by Sir David Milne-Watson at a Luncheon given to the Central Executive Board of the National Gas Council, Jan. 14.

I could have wished that the circumstances in which we hold our first meeting of the year were more reassuring. From the economic standpoint the national outlook is far from bright. Our own particular horizon is darkened by the ill-considered and highly dangerous proposals put forward in the Coal Mines Bill, which, so far from assisting the country in its present difficulties, will inevitably impose further financial burdens upon a community little able to bear them.

In the endeavour to fulfil a pledge which, in the circumstances, should neither have been asked nor given, the Government have allowed themselves to be forced into a reduction of hours which, as wages are not to be reduced, must necessarily raise the price of coal. Confronted on the other hand by the impossibility of placing a further burden on an industry recovering slowly from its wounds, largely self-inflicted, without at the same time administering "some sweet oblivious antidote," the Government have been forced into an alliance with the mining industry and are proposing to give to the coalowners, for whom they have had little good to say in the past, the power to regulate, practically without let or hindrance, the production and price of a commodity of prime necessity to every man, woman, and child in these islands, and, in regulating the price, to discriminate as they see fit between one class of consumer and another.

Let us examine first how the proposed system is intended to work, and then see what the consequences must be. The coalowners are to control and limit the national output of coal by fixing a quota to be produced by each colliery. No distinction will be made between efficient and inefficient pits. Each will be entitled to produce a quantity of coal based on its previous production. This will necessarily involve a reduction in the output of those collieries which are efficiently and economically conducted, and whose costs of production are, in consequence, relatively low, with the result that the general average cost of production of the whole coal supply will be increased. Further, this statutory interference with economic laws will put a premium on inefficiency. Owners of uneconomic pits, secure in the knowledge that they are certain of a market for the quantity of coal represented by their quota, will have but little incentive to reduce the cost of production by introducing better methods of working, or by installing up-to-date machinery and equipment.

It is true that the quotas of such collieries may be purchased by other collieries. But it is certain that the purchase prices asked and given can only be such as to increase the overhead charges of the purchasing firms above to-day's level.

The provisions in regard to the fixing of prices are no less objectionable. In fact, as I have emphasized elsewhere, they not only give to the coalowners the power of imposing what is virtually taxation, but even enable them to vary the incidence of that "taxation" in respect of different classes of coal consumer. Nor will this "taxation" be direct only. Coal for export is to be supplied cheap at the expense of the home consumer, thus enabling foreign manufacturers to compete still more favourably in both British and foreign markets with similar goods manufactured here. Even to-day I know of a case—and there are many more—where at a seaboard town coal is being loaded into ship for foreign buyers at 5s. 4d. less than is being asked in the same town for the same coal in similar quantities and for similar purposes.

How the Scheme of "Taxation" Will Work.

Minimum prices in respect of each class of coal consumer may be fixed, below which it will be illegal to sell to such users. This means that a variety of prices, determined by the use to which the coal is to be put, can be fixed for coal of the same nature. Thus gas undertakings may have to pay more than coke oven undertakings (with whom they are already in competition with coke and chemical products) for coal got from the same pit. It is, therefore, obvious that, unless the powers conferred are exercised with the most complete impartiality, unfair differentiation will result.

Clearly each minimum price will be as high as it is deemed possible to make it, and some at least of the principles to be applied in determining those prices are already manifest. No doubt dependence upon coal will be an important factor, for it must not be forgotten that imported fuel oil, which escapes "taxation" under the Bill, can in many cases be substituted for coal. It would indeed be a grim commentary if the only result achieved by the first part of the Bill were an increase in the import of oil.

Ability on the part of consumers to pay, as gauged, of course, by the coalowners, and ability to pass on increased costs to the public have also been mentioned as suitable tests. The public utilities, and in particular gas, electricity, and railways, have been officially indicated as desirable victims. Gas is apparently regarded as particularly defenceless in that it cannot be manufactured without coal (of which some 18 million tons are normally carbonized per annum) and must, therefore, pay the price demanded, however high it may be.

There are 9 million registered consumers of gas in this country, and that figure represents some 36 million people who in one way or another are dependent upon gas. Of those who use it for domestic purposes, a large proportion belong to that great section of the people for whom any increase in the cost of any of the necessaries of life is a serious hardship. On the industrial side—and gas is now used in thousands of industries—the increase will mean increased production costs, which must again be passed on to the public. No one, I venture to think, can view with complacency the starting of such a vicious circle, and those of us who are responsible for the gas supply of this country must do our utmost, for the sake of our consumers, our workers, and ourselves, to prevent the perpetration of a gross injustice.

If the Bill in some shape or form has to go through, then it must be radically altered. The power to inflict injury upon particular industries must be cancelled or curtailed. The Committees of Investigation, both Central and Local, must be given powers to intervene effectively, and provision must be made for the proper representation upon them of various industries. Accredited representatives of coal-using industries must be given a right of appeal.

Even so, the Bill will be thoroughly unsound economically, while it is bound to cause unnecessary hardship and injustice. Is it really necessary that it should be passed?

Time forbids me to mention other numerous objectionable features, such as the right to impose levies, the absence of public audit of accounts and expenditure, and the lack of facilities on the part of the coal-consuming public to consider and discuss the actual provisions of the schemes themselves; but, to summarize what I have said: This Bill is an attempt to apply artificial stimulants to the coal industry. Apart from its gross injustice to gas consumers, the following will be some of its results to the nation at large:

(1) To increase the cost of living.
(2) To increase the cost of production of British-made goods.
(3) To assist foreign manufacturers still further to compete successfully with British-made goods.

Such results would be deplorable, and the Bill ought not to be placed on the Statute Book, unless it can be found possible to amend it so as to avoid them.

Alderman F. S. PHILLIPS (Salford) voiced the thanks of those present to Sir David for his statesmanlike effort to help them at the present juncture in regard to the proposed Coal Mines Bill. He remarked that they all owed a very great debt to Sir David for what he had said to them, and he hoped that it might have its due effect. For himself, he was convinced that, if the politicians would let the coal industry alone to work out its own salvation, this would be the only sound way in which that desirable object could be achieved. Such attempts as the present Bill were merely going to bring about further distress, and hold back that which they all longed for—the restoration of the prosperity of the country. The National Gas Council owed Sir David a debt which it was absolutely unable to liquidate, and he would like also to acknowledge the indebtedness of the industry to Mr. Shapley for his recent admirable speech on the coal industry, which he felt sure would do good.

Mr. J. H. ELLIS (Plymouth), seconding the proposal, said he did not know anybody who could have made so lucid and comprehensive a statement, showing such a just appreciation of the nation's and gas industry's needs, as that to which they had just listened. He wanted Sir David to know that, in his advocacy of the industry's case, he had the wholehearted support of every member.

Sir DAVID MILNE-WATSON acknowledged the vote, and pointed out that the gas industry were by no means inimical to the coal industry. They were only longing for the day when the coal industry would put itself right. It was the basic industry of the country, and nothing was nearer to the hearts of those connected with the gas industry than to see the coal industry once more take its proper place. There was, however, a wrong way of doing this, and a right way, and they believed that the Government had chosen the wrong way. This was the sole reason for their criticisms.

In To-Day's "Journal."

Messages for the New Year.

The New Year messages of Sir David Milne-Watson and Dr. Charles Carpenter to co-partners in the Gas Light and Coke Company and the South Metropolitan Gas Company are published.

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Effect of Coal Mines Bill on Gas Consumers.

This is dealt with by Sir David Milne-Watson, in a speech which he delivered yesterday at a luncheon given to the Central Executive Board of the National Gas Council.

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Proposed Coal Monopoly in Ireland.

The Irish Association of Gas Managers have held a meeting to discuss an agreement which is stated to have been arrived at between the Irish Coal Importers' Association and colliery owners in Great Britain creating a virtual monopoly in regard to the import of coal into Ireland. A Special Committee has been appointed to keep in touch with the National Gas Council on the matter.

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Evolution of Vertical and Horizontal Retorts.

Under the title "A Carbonizer's Pilgrimage," Mr. H. J. Toogood contributes a paper in which he describes general advances in carbonization during the past twenty-five years, and refers particularly to the types of plant developed by Messrs. Robert Dempster & Sons, Ltd., and manufactured by this firm at Elland.

Liquid Purification by Soda Ash Solution.

Working results of the plant installed at the Southport Gas-Works are given by Mr. W. J. G. Davey, now Chief Chemist to the Birkenhead Gas Department. Among other matters, he deals with the recovery of thiocyanate in the form of the copper salt.

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Combustion and Flue Equipment.

The first instalment appears of the results of research carried out under the direction of Mr. C. A. Masterman at Watson House. The paper affords the first reasoned expression for determining, for a flue of given area or diameter, the critical height at which the products of combustion will be completely removed and sufficient draught provided to meet combustion requirements in all normal circumstances.

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Virtues of Clean Coal.

Dr. R. Lessing explains the method of working of a large-scale coal cleaning plant in South Wales, and gives his views of the influence which the supply of clean coal would have on the carbonizing industries.

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New Distribution Workshops at Leeds.

An account appears of the opening of new distribution workshops of the Leeds Corporation Gas Department. In these extensive and splendidly-equipped shops, repair work in connection with distribution and lighting is centralized.

Personal.

On Jan. 1, Mr. D. CLEAVE CROSS took up his duties as Engineer and Manager to the Lea Bridge District Gas Company. He entered the service of the Company in 1903, being articled under his father, Mr. F. W. Cross, for 5 years. He worked in all departments, and in 1909 was appointed Chief Works Assistant. In 1914 he was promoted to Works Manager; and on the partial retirement of Mr. F. W. Cross in 1926 was appointed Engineer. Mr. Cleave Cross won the City and Guilds Bronze Medal for Gas Engineering, and in 1913 was elected an Associate Member of the Institution of Civil Engineers. During 1922 he was President of the London and Southern District Junior Gas Association.

Mr. A. VINCENT KEMP, M.I.Mech.E., M.I. & S.I., Consulting Engineer (late Director of the Wellman Smith Owen Engineering Corporation, Ltd.), has become associated with Gas Chambers and Coke Ovens, Ltd., Artillery House, Westminster, S.W. 1, who are the sole licencees in the British Empire for the Collin Coke Oven Plant and builders of the "C.O.L." intermittent vertical chamber ovens. It is understood that Mr. Kemp will still continue his consulting practice in connection with furnace and heat treatment equipment for all metallurgical purposes.

Baron BROTHERTON of Wakefield has been awarded the Messel Memorial Medal for 1930. This medal is awarded by the Society of Chemical Industry every two years to one who has earned meritorious distinction in science, industry, or literature, or who has assisted prominently in the welfare of the Society. Baron Brotherton has been a member of the Society since its commencement nearly fifty years ago, and is now one of its Vice-Presidents. Previous recipients of the medal have been Prof. H. E. Armstrong, the late Viscount Leverhulme, Earl Balfour, and Prof. R. A. Millikan.

In the January issue of the "Co-Partnership Journal" of the South Metropolitan Gas Company, mention is made of the retirement of a number of long-service co-partners. Among them is Mr. C. RICHMOND, Chief Draughtsman, who has 27 years' service to his credit.

Obituary.

SIR LAWRENCE WEAVER.

Sir Lawrence Weaver died at his home in St. John's Wood on Jan. 10, at the age of 53, after an illness of only two days. His activities in connection with the British Empire Exhibition brought him in close touch with the gas industry, to whom he remained until the last a great friend, and by whom he will be greatly missed. Only a few weeks ago, apparently in perfect health, he delivered, for the second year in succession, a notable address before the Annual Conference of the British Commercial Gas Association. He was created a C.B.E. in 1918, and advanced to K.B.E. in 1920. No better appreciation could be offered than that by "L. of F." in "The Times" of Saturday last, which we quote in its entirety here:

There is an element of public, as well as of private, tragedy in the untimely death of Lawrence Weaver, for, apart from the lovable qualities which made his friendship very precious to those who knew him best, he came nearer than anyone else, in the present writer's estimation, to being the "indispensable man" in each department of public work (and they were many) with which he was associated. Apart from his business ability, which was of the highest order, he possessed a breadth of vision and a generous enthusiasm which, while controlled by shrewd and penetrating common sense, had in them something of the faith which can remove mountains and inspire colleagues to reject the word "impossible."

He was a relentless worker; never willing, as the event, alas, has proved, to consider his own health or strength, but all that he did was done with so much gusto and *joie de vivre* that he infused a sense of adventure, and even of fun, into the most grinding tasks. In consequence he had a devoted following of younger men, notably in the architectural profession and the field of agricultural research, who were always ready to go all out under his leadership and to hitch their wagons to a star.

To his seniors, also, his work, and the spirit in which it was conceived and executed, was an inspiration as well as an abiding comfort, and much for which they received the credit and rewards was in reality his doing and should have been recognized as such. Of his more recent activities, one of the most strenuous, while at the same time the least conspicuous, was in connection with the "Haig Memorial Homes," of which he was a Trustee and virtually the Managing Director. It is no exaggeration to say that, apart from the funds provided by the generosity of subscribers, the credit for the advanced state and the practical "seemliness" (a word which he loved) of the various housing schemes throughout the country is mainly due to his untiring labours and personal supervision. Into this, as into all other philanthropic enterprises with which he was identified, he threw himself heart and soul, and while his achievement is already sufficient to constitute a permanent monument to his memory, of the kind he would have best loved, the loss of his guiding hand from the helm will be deeply felt by his colleagues and fellow-workers and in some respects found to be irreplaceable.

To his intimates the sudden taking of this virile, joyous, and compelling personality from their midst comes as a grievous and almost staggering blow, while of the deeper tragedy which has fallen upon his family only those who were privileged to know something of the beauty and holiness of his private life can form any adequate realization. The closing words of Stevenson's "Aes Triplex" seem singularly appropriate to Lawrence Weaver's passing:

"Death has not been suffered to take so much as an illusion from his heart. In the hot-fit of life, a-tiptoe on the highest point of being, he passes at a bound on to the other side. The noise of the mallet and chisel is scarcely quenched, the trumpets are hardly done blowing, when, trailing with him clouds of glory, this happy-starred, full-blooded spirit shoots into the spiritual land."

Commercial and Industrial.

Stock Market Report.

[For Stock and Share List, see later page.]

There were distinct signs of a revival of interest in Gas Stocks and Shares last week. This is doubtless due to the fact that investors generally, having in mind the financial crises of 1929 and the present prospect of cheaper money, are showing more willingness to purchase high-class securities, though some of the more speculative shares are not without some support. Transactions, therefore, were more numerous than for the past few weeks, and prices hardened in consequence. The Imperial Continental capital stock, after a brief period of inactivity, has again been in demand and the quotation increased 15 points to 345-365, business being done at 358½ against the highest price of 335 the previous week. Primitiva ordinary shares advanced 1s. 6d. to 28s.-30s., but no transactions were recorded. Other increases to note were: Gas Light, 4½d. per £1 stock to 18s. 1½d.-18s. 7½d.; Montevideo, 3 points to 105-110; and Tuscan, Ltd., £10 ordinary shares 2 to 3½-4½, and 6 p.ct. debenture 5 to 75-80.

It will be observed in the Stock and Share List that the Wandsworth Company's ordinary and debenture stocks, in accordance with their Act of 1929, have been converted into £1,180,970 consolidated ordinary stock and £488,344 5 p.ct. debenture stock. The terms of the conversion, which dates from Jan. 1 this year, are as follows:

Holders of £100 "A" stock receive £129 Consolidated Stock.
Holders of £100 "B" stock receive £107 10s. Consolidated Stock.
Holders of £100 "C" and New stock receive £90 Consolidated Stock.
Holders of £100 Wimbledon 5 p.ct. receive £105 10s. Consolidated Stock.
Holders of £100 Epsom 5 p.ct. receive £109 Consolidated Stock.
Holders of £100 3 p.ct. Debenture Stock receive £60 5 p.ct. Debenture Stock.
Holders of £100 4 p.ct. Debenture Stock receive £80 5 p.ct. Debenture Stock.

The first quotation of the consolidated stock is 105-110; no change being made in that of the 5 p.ct. debenture stock.

Coal Markets.

The various markets have been getting into their stride again after the disturbance of the holidays, and business is reported as satisfactory on the whole. For early positions most sections of the Newcastle market are firm, best Northumberland and best Durham bunkers being especially in demand. Gas coals are rather quiet for the time of year, but best qualities remain firm at 16s. 9d. to 17s. f.o.b., with Wear specials round 17s. 3d. Ordinary qualities are about 15s. 3d. to 15s. 6d. In Yorkshire, official export prices are 18s. to 18s. 6d. for screened gas or washed trebles, 17s. 6d. to 18s. for washed doubles, and 16s. to 16s. 6d. for washed singles.

While prospects appear good for this month, and to some extent next, there is little disposition on the part of buyers to operate further ahead, in view of the uncertain prospects. Tonnage was in good supply at the ports last week, and freights were on the easy side.

Trade Notes.

Rotary Displacement Pumps.

From Messrs. Stothert & Pitt, Ltd., of Bath, we have received a copy of their recently published catalogue on the subject of rotary displacement pumps. In this will be found illustrations of many forms of pumping plant showing the further development which has taken place in the use of their designs for the majority of fluids, especially those of high viscosity.

A New Catalogue.

The new catalogue (No. 107), recently published by Messrs. Lighting Trades, Ltd., and the Welsbach Light Company, Ltd., can almost be regarded as an encyclopædia of gas appliances and fittings. Besides dealing comprehensively with domestic lighting with the most up-to-date and attractive fittings, there are interesting sections on church and school fittings and public lighting, together with particulars of the firm's latest lines in controllers, fires, radiators, cookers, irons, and hot water apparatus.

The "A.W.P." Hire Service System.

Bulletin No. 55, recently published by Alloy Welding Processes, Ltd., deals with the firm's hire service system. Many firms are faced with the difficulty that they are not sure as to whether, in their particular case, electric arc welding would be found to benefit them, and they naturally hesitate to purchase the necessary equipment till they can be sure of the saving they would make. In order to overcome this difficulty, "A.W.P." have inaugurated a hire system under which any type of plant can be hired at small monthly rentals. Such plant will be maintained in an efficient state at all times, and in connection with the system skilled demonstrators will call from time to time to ensure that the plant is working efficiently, and such demonstrators will advise the hirer regarding the best methods, and the best type of material to be used for varying classes of work. The Bulletin sets forth some of the advantages to be gained by the system, and quotes terms for certain typical examples of plant.

Current Sales of Gas Products.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 13.

There is no change to report in the prices of tar products.
Creosote for export is 6¼d. to 6¾d. per gallon f.o.b.
Pitch is 47s. 6d. per ton f.o.b.
Pure toluole is 2s. 5d. to 2s. 6d.; 95/160 solvent naphtha, about 1s. 5d.; pure benzole, about 1s. 11d.; and pyridine bases, about 3s. 9d., all per gallon.

Tar Products in the Provinces.

Jan. 13.

The average prices of gas-works products during the week were:—Gas-works tar, 25s. to 30s. Pitch—East Coast, 47s. 6d. f.o.b. West Coast (f.a.s.) Manchester, 42s. to 42s. 6d.; Liverpool, 45s. 6d. to 46s. 6d.; Clyde, 45s. 6d. to 46s. 6d. Toluole, naked, North, 1s. 7½d. to 1s. 8½d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3d. to 1s. 3½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3½d. to 3¾d.; low gravity, 2d. to 2¼d.; Scotland, 3½d. to 3¾d. Heavy oils, in bulk, North, 5½d. to 6d. Carbolic acid, 60's, 2s. 4d. to 2s. 6d. prompt. Naphthalene, £12 to £14. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Tar Products in Scotland.

GLASGOW, *Jan.* 11.

Trade is gradually resuming normal proportions. There has been a decided increase in the number of inquiries and orders particularly for forward delivery.

Pitch.—The nominal value in this area remains at 47s. 6d. to 50s. per ton f.a.s. Glasgow. Home orders command about 5s. per ton premium.

Tar.—The value continues steady, and a fair volume of business is passing at current level of about 4d. to 4¼d. per gallon in buyers' packages at makers' works.

Creosote.—No alteration is expected in the immediate future. The value remains fairly steady at 3⅝d. to 4⅜d. per gallon for B.E.S.A. specification. Light oil is 3¼d. to 3⅝d. per gallon, and neutral oil 3d. to 3¼d. per gallon all free on rails works.

Cresylic.—The tendency is towards lower prices; but in this area stocks are still low. Pale 97/99 p.ct. is 1s. 9¼d. to 1s. 10½d. per gallon; dark 97/99 p.ct., 1s. 7¾d. to 1s. 8¾d. per gallon; pale 99/100 p.ct., 2s. 0¼d. to 2s. 1¾d.; high boiling, 1s. 11d. to 2s. per gallon, all f.o.r. makers' works.

Crude Naphtha.—The market is quiet, and value is easy at about 5¼d. to 6d. per gallon.

Solvent Naphtha.—There is very little business passing at present. 90/160 grade is 1s. 1¾d. to 1s. 2d. per gallon and 90/190, 1s. to 1s. 0¾d. per gallon.

Motor Benzole is quiet at 1s. 5d. to 1s. 5½d. per gallon.

Pyridine remains at about 3s. 3d. to 3s. 6d. per gallon for 90/160 grade. Heavier grades are unsaleable meantime.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10 to	0 11	per gallon at works
Motor ,, . . .	1 5 ,,	1 6	,, ,, ,,
90 p.ct. ,, . . .	1 7 ,,	1 8	,, ,, ,,
Pure ,, . . .	1 10 ,,	1 11	,, ,, ,,

Overseas Opportunities.

[From the Board of Trade Journal.]

India.

Distribution Piping, Specials, Valves, and Accessories for the Water Supply Scheme at Jaipur (Order No. N. 10,128).—H.M. Trade Commissioner at Calcutta reports that the Indian Stores Department is calling for tenders, to be presented in New Delhi by Jan. 22, 1930, for the supply of the above. Firms desirous of offering materials of British manufacture can obtain further particulars of this call for tenders upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1. (Ref. A.X. 8975.)

Water Pipes and Accessories.—H.M. Trade Commissioner at Calcutta reports that the Indian Stores Department is calling for tenders, to be presented in New Delhi by Jan. 21, 1930, for the supply of cast-iron, mild steel or corrosion-resisting ingot iron piping, specials, and valves (Order No. N. 10,308). Firms desirous of offering materials of British manufacture can obtain further particulars of this call for tenders upon application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W. 1. (Ref. A.X. 8971.)

Contracts Open.

Coal.

The City of Plymouth invite tenders for the supply of coal. [See advert. on p. 166.]

Topical Items.

Joint Gas Conference at British Industries Fair.

A Joint Gas Conference will be held on Tuesday, Wednesday, and Thursday, Feb. 18, 19, and 20, at the British Industries Fair, Castle Bromwich, Birmingham.

PRELIMINARY PROGRAMME.

TUESDAY, FEB. 18.

10.30 a.m.	Assemble at Conference Hall, British Industries Fair, Castle Bromwich. Opening of Conference.
11. 0 a.m.	Paper by Member of the Society of British Gas Industries, "Gas Lighting," to be followed by a discussion.
1. 0 p.m.	Official Luncheon at the British Industries Fair (delegates paying for their own luncheon).
Afternoon.	Inspection of exhibits at the Fair.

WEDNESDAY, FEB. 19.

10.15 a.m.	Assemble at Conference Hall, British Industries Fair.
10.30 a.m.	Paper by Mr. A. H. Barker, B.Sc., B.A., Whit.Sch., M.Inst.C.E., Consulting Engineer, Lecturer on Heating and Ventilating Engineering, University College, London. "The Comparative Costs of Domestic Fuel." Discussion.
1. 0 p.m.	Luncheon at British Industries Fair by invitation of the Fair Management Committee.
Afternoon.	Inspection of exhibits at the Fair.
4. 0 p.m.	Meeting of the General Committee of the British Commercial Gas Association.

THURSDAY, FEB. 20.

10. 0 a.m.	Assemble at the Warwick Room, Queen's Hotel, Birmingham.
10.15 a.m.	Reading and discussion of paper to be provided by the Institution of Gas Engineers. No special arrangements are being made for Luncheon. The Conference will finish officially at about 1 p.m., and those members who wish to visit the Fair in the afternoon will be free to do so.

Gas Managers Alarmed at Proposed Coal Monopoly in Ireland.

An agreement is stated to have been arrived at between the Irish Coal Importers' Association and colliery owners in Great Britain, creating a virtual monopoly in regard to the import of coal into Ireland. The matter was discussed at a meeting in Dublin, last week, of the Irish Association of Gas Managers, when it was decided to take action with a view to preventing the scheme going through. It was declared that the gas industry would suffer severely as a result of the scheme, as the price of coal would be raised, and the gas companies would have no choice of the kind of coal they wanted. It was also stated at the meeting that four gas companies were exempt from the operations of the scheme—Dublin, Belfast, Cork, and Dundalk.

Mr. W. Buckley, President of the Irish Association of Gas Managers, questioned why the gas managers were not consulted as to the position before the Irish coal merchants completed the scheme, and why exceptions were made in favour of four gas-works. No reason could be shown why Belfast, Dundalk, Dublin, and Cork gas-works should be exempt.

Mr. O'Callaghan (Omagh), Mr. Law (Limerick), Mr. Roberts (Donaghadee), Mr. Young (Carlow), Mr. Reid (Ballina), and Mr. G. Airth (Hon. Secretary of the Association) spoke against the scheme; and Mr. Walmsley (Londonderry) proposed a resolution viewing with considerable apprehension the proposed Irish coal marketing scheme, "as, owing to the elimination of open competition and the introduction of a further intermediary —viz., the selected coal importer—between the colliery and the user, it will undoubtedly increase the cost of coal, which will ultimately re-act on the consumer by an increase in the price of gas. Furthermore, it is absolutely essential that a free choice of coal is available for gas production to suit the different methods of carbonization and as regards residual products to suit the particular needs of different localities, and it is resolved that representation be made to the National Gas Council with a view to the matter being brought to the notice of the Government Departments in London, Dublin, and Belfast, or dealt with in any other way they consider desirable. It is further decided, if the scheme is proceeded with, that inquiries be made as to the possibility of importing suitable gas coals from collieries outside the suggested scheme of operations."

Mr. Mitchell (Bangor) seconded the motion, which was passed.

On the motion of Mr. Harrison (Armagh), seconded by Mr. O'Callaghan, the following were appointed a Special Committee to keep in touch with the National Gas Council regarding the matter: Messrs. Walmsley, Mitchell (Bangor), Airth (Dundalk), and Buckley (Tralee).

At the last meeting of Ballymena Urban Council, Mr. David Henry said that the Council ought to pass a resolution on the matter, and send copies of it to the different local authorities who owned gas-works, and also to the various gas companies in Northern Ireland. A copy should also be sent to the Minister of Home Affairs. It was an important and an urgent matter, and it would seriously affect all gas consumers.

The Council adopted a resolution, stating that the operation of the suggested scheme as applied to public utility undertakings would be detrimental to the efficient working and administration of the Council's Gas Department. "The Council," the resolution declared, "view the scheme with disfavour, and, if necessary, will take steps to see that the suggestions will meet with the utmost publicity, and that their gas undertaking will claim the same rights and privileges as those other gas undertakings (if any) who have received exemption under the scheme."

It was resolved to send copies of the resolution to other public authorities.

Holborn Borough Council Complain of Inactivity of Post Office.

At a meeting of the Holborn Borough Council last week, the Works and General Purposes Committee reported that the old disused Post Office pneumatic tube, which runs for some considerable distance east of Kingsway, was in exactly the same condition as before the explosion in December, 1928. The only ventilation of the tube was by means of a cellar opening on to the lift well at the telephone exchange in High Holborn. There was in addition a small section of the tube, about 45 ft. in length, under High Holborn which was entirely without ventilation.

The report continued: "Viewing with grave alarm a state of affairs creating, as it must, a feeling of uneasiness at the possibility of a recurrence of the disastrous upheaval twelve months ago, the Committee expresses regret that the Post Office authorities have not yet taken any apparent steps to give effect to the recommendation of the Commissioners intimating that steps to ventilate adequately the disused pneumatic tube should be taken."

The Committee recommended that a communication should be addressed to the Postmaster-General stating that the Council viewed with serious alarm this apparent inactivity on the part of the Post Office authorities.

The Council's recommendation was unanimously agreed to.

The Postmaster-General (Mr. H. B. Lees-Smith) issued a statement on Jan. 9 with reference to the matter. He said: "After collaboration with experts on the ventilation of tunnels, a large power-driven fan has been installed for the purpose of driving air into the tube. Ventilating covers have been fitted on a number of manholes of the tube, and similar covers are in process of being fitted at the remaining manholes. Experiments are also being made with gas detectors which would enable the fans to be started automatically.

"In the meantime the safety of the whole system is being ensured by systematic tests for the presence of traces of gas in the tube. These tests are made twice a week and have been taken since last summer. No traces of gas have, however, been found, and the Postmaster-General wishes to assure the public that there is no danger resulting from the presence of the pneumatic tube. The statement that a 45-ft. unused length of tube in Holborn is unventilated is not correct. There is a ventilator in this portion of the tube."

Gas-Works in Westmorland to be Re-Modelled and Re-Conditioned.

On Wednesday, Jan. 8, Lieut.-Col. L. F. WELLS, D.S.O., M.Inst.C.E,, an Inspector to the Ministry of Health, held a public inquiry at Kendal Town Hall into the application by the Town Council to borrow £18,000 for the re-modelling and re-conditioning of the Gas-Works. The Town Clerk, at the request of the Inspector, presented statistics as to acreage, rateable value, &c. The area of the district was 2700 acres; the population was estimated at 16,500 within the area of gas supply. Further details of outstanding loans, unexercised sanctions, &c., were gone into.

Alderman THOMAS, Chairman of the Gas and Water Committee, said their trouble was that the consumption of gas had exceeded the capacity of the plant, and their Engineer and Manager, Mr. T. C. Crowdy, had made representations to

them in 1928 and the early part of 1929 as to the capacity of the plant. As a result of Mr. Crowdy's report upon the works, the Committee and Council had made a recommendation that they should be re-modelled and re-conditioned. Mr. Crowdy considered that they would not be in a safe position, and recommended plant capable of dealing with one million c.ft. of gas per diem,

Some of the plant dated back to 1878, and was designed to deal with 20,000 c.ft. per hour, whereas at peak loads it was called upon to deal with 27,000 c.ft. per hour. The Inspector went very carefully into the plans, specifications, and proposed layout as prepared by Mr. Crowdy, who was questioned as to provision of gas storage accommodation, in reply to which Mr. Crowdy said that that point had not been overlooked, and if it was found necessary, "flying lifts" could be added to the existing holders, or a district holder be erected; at the moment there was no anxiety as to storage. The Inspector suggested that the Department might keep an eye on any likely land that could be obtained in close proximity to the works, and he afterwards visited the works.

Two hundred houses are to be built in Kendal almost immediately, and in addition to this, there are 470 cookers to be installed. The gas output has increased by over 4 million c.ft. for the 9 months ending Dec. 31, 1929, and a large number of gas cookers, fires, geysers, wash-boilers, irons, &c., have been fixed. The distribution system is being thoroughly overhauled, and several thousands of yards of services and mains are being renewed.

The Ministry of Health recently sanctioned loans as follows: Mains (cast-iron and steel) and services, £2941; meters, £3000; and cookers, £3000.

Elstree and Boreham Wood Amalgamation.

A Special General Meeting of the shareholders of the Elstree Gas Company, Ltd., was held on Jan. 7, to give consent to a provisional agreement made between the Watford Gas and Coke Company of the first part, the St. Albans Gas Company of the second part, and the Company of the third part, which provides for the transfer of the undertaking of the Company to the Watford Company (which after the amalgamation of that Company with the undertaking of the St. Albans Company, is to be known as the Watford and St. Albans Gas Company), subject to such alterations (if any) as the Board of Trade or Parliament may think fit to make therein, and the Directors of the Company shall accept.

Mr. R. J. MILBOURNE, J.P. (Chairman of Directors), in submitting the above resolution, said he felt sure that the shareholders would unanimously support the action of the Board in completing the amalgamation of the Elstree Gas-Works with their larger neighbours, especially as the district showed unmistakable signs of rapid development, which would necessitate the extension of their gas-making plant, and for which an increase in capital would be absolutely necessary. Being a comparatively small undertaking, surrounded by gas-works of a substantial size, the Board of Directors were convinced that it would be in the best interests of the shareholders and consumers, to join forces with Watford, as this Gas Company could manufacture the gas at much less cost. It had always been found somewhat difficult to raise capital for the smaller gas undertakings in the London area, unless an abnormal rate of interest were offered.

Mr. CHARLES CHAMBERS (Director) seconded the resolution, which was carried unanimously.

Safety in Mines Research Board Papers on Inflammability of Coal Dust.

Coal dusts vary greatly in their degree of inflammability, but there has not existed hitherto a laboratory test of this inflammability capable of replacing satisfactorily the laborious and rather costly method of repeated trial in large scale explosion galleries. The difficulties involved in producing a simple test were discussed in Safety in Mines Research Board Paper No. 31, published a year or two ago.

Such a test has now been evolved and is described in Paper No. 56, by A. L. Godbert and R. V. Wheeler, just published. (H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.) The method of test is to measure the inflammability by ascertaining the proportion of inert dust necessary to suppress inflammation when small quantities are blown by oxygen through a heated tube. It has been proved to give results comparable with the explosion gallery trials.

A refinement of the same test was used to study the effect of the fineness and chemical composition of coal dust on its inflammability. Safety in Mines Research Board Papers Nos. 33 and 48 had shown that the inflammability of a coal dust ran roughly with its volatile matter content, but there were notable exceptions to the general rule. Paper No. 56 proves that there is a much closer relationship between the inflammability of a coal dust and the reactivity of its ulmin compounds, as demonstrated by their relative capacity for absorbing oxygen. Occluded gases were found not to affect materially the inflammability of the dusts.

Two New Publications of the Water Pollution Research Board.

The Department of Scientific and Industrial Research have published "Water Pollution Research" Technical Paper No. 1 —"Water Softening by the Base Exchange or Zeolite Process," by Dr. A. R. Martin. The softening of water by the base-exchange process is assuming increasing importance, and this report summarizes existing knowledge of the subject. Following a brief historical introduction, the technique of the process is described, and its advantages and disadvantages in comparison with the older lime-soda process are set out. The preparation of base-exchange materials is briefly described, and the concluding sections, dealing with the theory of the process, serve to indicate the incompleteness of existing knowledge in this direction. The report is obtainable from H.M. Stationery Office, Adastral House, Kingsway, W.C. 2, price 6d. net.

Another publication, obtainable from the same source, price 1s. 3d. net, is a "Summary of Current Literature" on water pollution research (Abstracts Nos. 1 to 119). The preparation of monthly summaries of current scientific and technical literature dealing with water supplies, sewage, trade waste waters, river pollution, and relevant subjects was commenced by the Department of Scientific and Industrial Research in October, 1927. These summaries were compiled primarily for the information and guidance of the Water Pollution Research Board of the Department, and a limited number of copies were circulated in neostyled form. There was evidence that the summaries would be of considerable value to many authorities and individuals interested in the subjects with which they deal. It has, therefore, been decided to commence publication of selected abstracts. Publication will be monthly, and subject and author indexes will be issued annually. The abstracts are prepared by the Water Pollution Research Staff.

Measuring Gas Temperatures.—Herr H. Schmick, in a recent issue of the "Zeitschrift für technische Physik," describes a method for measuring gas temperatures, based on the fact that when a gas is passed through a valve at a certain speed the pressure difference is approximately proportional to the absolute temperature.

Coke Oven Gas for Paris.—It is reported in the French papers that a Company is being formed in France with a capital of nearly £1,000,000 for the construction of a pipeline 120 miles long between the Lens coalfield and Paris, for the purpose of supplying consumers in the French capital with coke oven gas for power, lighting, heating, and cooking purposes.

Voluntary Liquidation of Nitram Ltd.—It has been decided to transfer the undertaking of this Company to Imperial Chemical Industries, Ltd., with whom the firm have always been closely associated, and whose organization will, as far as necessary, carry out their unexecuted contracts. For this reason Nitram Ltd. has gone into voluntary liquidation.

Plant Extensions at Dewsbury.—A Ministry of Health inquiry is to be held at Dewsbury into the application of the Town Council for borrowing powers for the construction of a new gasholder, condensers, &c. The Unemployment Grants Committee has promised assistance in the laying of gas main in Soothill Lane, the work to be completed in a month from Jan. 6.

Canadian Gas Association "Question Box."—Present indications are that the 1930 Convention to be held in Halifax, N.S., on June 24 and 25, will be successful in every sense of the word. An attractive innovation is the introduction of a "question box." The object of this scheme is to enable members to have their own subjects discussed at the Convention. All they have to do is to jot down such points as they would like to receive attention and send them along to the Secretary. No names are mentioned in connection with the matters discussed.

A Food Parliament in the Midlands.—Four trades united in the organization of a national parliament of food, which was opened at Bingley Hall, Birmingham, yesterday, by Dr. T. Drummond Shiels, M.C., M.P., Parliamentary Under-Secretary of State for the Colonies. This event, incorporated with the annual exhibition in the Midlands of the Grocery, Bakers', Confectionery, and Catering Trades, which this year is to be extended in duration, is attracting food experts, producers, and distributors from all parts of the kingdom. Nine Governments are taking part as exhibitors and in other ways.

Sir David Milne-Watson's Message to Gas Light and Coke Company Co-Partners.

It is, I suppose, the common practice of most individuals and institutions to take stock at the beginning of a New Year, a very right and proper thing to do, and it is no less right and proper for all co-partners to follow this practice, both in regard to their relationship to the Company and to the outside world.

At the present moment, there are many troubles in the industrial world for which it is difficult for anyone to find a solution. We can, however, " do our bit " for the general well-being by strenuous efforts to make our own particular industry more and more efficient.

The year that is past, I am glad to say, has been for us one of progress and expansion of business. More gas has been sold than ever before, and, notwithstanding many difficulties, the Company has passed through one of the most successful years of its long existence. The co-partnership holding in the Company has also increased; but this material aspect is not really the most important—the most important is the spirit of co-partnership. At the New Year a great many people make resolutions—here is one for us all, to try to the best of our ability to carry into our work the true spirit of co-partnership.

The coming year will no doubt bring its own difficulties. It is quite obvious that we shall have to fight for justice for our industry with regard to the proposed coal selling schemes, and, moreover, there is always electrical competition to be reckoned with. It does not seem to matter what Government is in power, all politicians seem to treat electricity as a thing to be fostered in every possible way, while gas receives very little, if any, encouragement. We have, therefore, to rely upon ourselves and our own efforts to secure the Company's prosperity, but it can very largely be assured if every co-partner will do his duty.

The beginning of the year 1930 has special interest for the Company, as it sees the amalgamation of the undertakings of the Grays and Tilbury, and the Pinner Gas Companies with our own. All the regular employees of these two Companies will immediately become co-partners, and I wish to extend to them all a very warm welcome to our midst.

Training for Management—Constructive Ideas

The air is full of discussion as to the best training for leadership in industry; the rival cries of the educationalist and " the practical man who began at the bench," of the classical scholar and the scientific research expert, are loud in the land.

Fortunately, the Institute of Industrial Administration, whose offices are at 47-51, King William Street, E.C. 4, has now completed the working-out of a complete system of study for those who seek to fit themselves for " those £10,000 a year jobs," and for positions leading up to them.

Mr. A. S. Comyns Carr, K.C., whose legal experience has brought him into close touch with the need for such a movement, without attaching him to any particular section or theory, is supported as President by a strong body of Vice-Presidents which includes Sir John Thornycroft, of engineering and shipbuilding fame, Sir Kynaston Studd, Bart., late Lord Mayor of London, Mr. J. Maughfling, President of the Society of Motor Manufacturers and Traders, and other leading public men.

A strong Board of Examiners is headed by Principal H. Schofield; and Mr. E. T. Elbourne, the Hon. Director, is not only a practical manager, but a consultant of long experience.

The Institute is concerned, not with the technical problems of any one industry, but with the problems of management common to them all. It has laid down a definite course of instruction, and is holding examinations in the surprisingly wide range of knowledge which is, or should be, common to management in all industries.

The Institute seeks to to raise management to the status of an organized profession. It is enrolling employers, managers already qualified by experience, and young people who desire to qualify themselves by study, in the common aim of raising the standard of management of British industry.

European Activated Carbon Agreement.—It is announced that an agreement in regard to the close co-operative working and selling has been reached between the two major European groups of activated charcoal producers. The first group comprises the N. V. Algemeene Norit Maatschappij and the Verein für Chemische Industrie in Frankfort. The second, or " Carbo Union " group, comprises the I. G. Farbenindustrie A.-G. and the Metallgesellschaft A.-G., of Frankfort, and the Verein für Chemische und Metallurgische Produktion of Karlshad. Apparently the only outstanding producer is the French firm, the Compagnie des Produits Chimiques et Charbons Actifs Ed. Urbain of Paris.

Dr. Charles Carpenter's New Year Message to South Metropolitan Co-Partners.

There has been recently considerable correspondence in the daily press upon the subject of the most suitable words to be used for giving or transmitting directional orders pertaining to the steering of ships. As everybody knows, these are to-day " starboard " and " port," the latter word having been substituted early in the century for " larboard," which the former too nearly resembled.

The discussion was an interesting reminder how deeply the overseas interests of the Empire have entered into the life of the nation. Whether these interests are so widespread now as in my childhood is uncertain, but judging rather as the " man in the street " than as the statistician, I think it is doubtful. At any rate, I think that Londoners then saw more of ships and shipping than is now the case, if for no other reason than the one that in those days the Thames was in daily use as an auxiliary highway. Steamboats carried a goodly number of those who, from business as well as pleasure motives, desired to travel between Westminster and Greenwich with extensions to Chelsea and the upper reaches in one direction, and Woolwich and Gravesend in the other. I should think, too, that a much larger number of persons were at that time interested in the upkeep and finding of ships than is now the case, for there were shipbuilding and repairing yards up and down the stream on both banks, and the great marine engine builders had still their works there, while rope works, block-makers, anchor-smiths, and chain-makers were in general evidence.

Though we are still a maritime nation, I believe we were then the great seafaring people, and the language of the sea and the ships that sailed upon it entered largely into our common life. I remember quite well as a child the expression " A 1 " being explained to me; how it was a symbol for ship classification upon Lloyd's Register, and how it signified that a vessel was well-built, well-found, and adapted to meet the storm and stress she would be likely to encounter in her journeyings across the oceans. The expression A 1 became, as I have said, of everyday use, as applied not only to a ship's classification, but to one's health, one's business, one's enjoyment, and one's feelings.

During the war another symbol came into unpleasant prominence, for the examination and classification of the people opened the country's eyes to the unwelcome fact that a large proportion of its inhabitants could certainly not be rated A 1, and a new class or rating altogether had to be created—namely, C 3. The politician who discoursed so frequently and so eloquently upon the nation's post-war tasks referred often and long to the importance of eliminating, or at least greatly reducing, that new class of C 3 beings. How far such a task can be undertaken by Parliament or its politicians I am doubtful, for I believe more progress will be made by a general desire to lead healthier lives than by any Acts. If we will think seriously about our mode of living and lend a serious ear to the disinterested and unselfish teaching of those who have given up their lives to a study of health matters; if we will place our faith in science and turn a deaf ear to quackery, it will be found there is much we can do to ensure our enjoying A 1 lives.

Quite accidentally this particular number of the South Metropolitan Gas Company Co-Partnership Journal contains an interesting report of a discussion which took place at a recent Co-Partnership Committee meeting upon this question of general health, and the attention of co-partners is especially directed to it. Co-partners do not need to be reminded that very much has been done by the Company since the war to promote the healthiness, mentally as well as physically, of its employees. (Facilities for recreation of all kinds constitute some of these efforts, but by no means the only ones, for it cannot be gainsaid that we must live primarily by work and not by play.) Sports grounds, concert halls, gymnasia, &c., make their obvious appeal.

But the importance of adopting the best means of keeping in order the human machine by as complete an examination as is possible, if it is suspected of failing, is often overlooked. It was with this in their mind that the Directors determined to instal an up-to-date instrument called the Cardiograph, and just as the steam indicator enables us to verify the working of an engine, so does the Cardiograph enable the physician to observe the working of that human engine, the heart. Colonel Oswald told us the other day that of youths applying for employment with us, he found 20 p.ct. were suffering from " tobacco heart." We shall certainly not be able to build up an A 1 nation from such material, nor would a gas-works be a suitable place to try to do so. The Company's desire is, as far as its means allow, to pay " healthy " wages, and it is surely entitled in return to expect a healthy service.

We are very greatly indebted to the efforts of our medical and dental officers for their unremitting endeavours to raise the physical fitness of all our employees. And that they may make still further progress in this direction during 1930 is perhaps the best hope I can associate with my earnest wish that for all co-partners it may prove a happy New Year.

Demonstrations for Gas Scientists at Annual Exhibition of the Physical and Optical Societies.

At the Annual Exhibition of the Physical and Optical Societies, which was staged last week at the Imperial College of Science and Technology, South Kensington, there was much to interest gas scientists. The research and experimental section was particularly attractive. In this the Gas Light and Coke Company had several informative exhibits. There was a device designed to indicate when a street photometer is normal to incident light, and at what angle below the horizontal the light is reaching the instrument. Demonstration was given of the rate of water penetration of protective coatings on pipes—an application of the standard method for testing cable insulation, somewhat modified by the greater range of resistances which have to be dealt with. A model of a special type of hot water storage boiler showed clearly the "hot water layer" formed, and there was an apparatus which records any variation in a thermostat's action.

Also on the stand of the Gas Light and Coke Company, there was demonstrated a method for rapid measurement of corrodibility of iron in contact with water and carbon dioxide. The method depends upon a measurement of the rise in conductivity of the electrolyte due to the solution of the iron in aqueous carbon dioxide solution, and enables comparison of the rate of corrosion between two specimens of iron or steel to be made within the space of a few hours. One advantage is that all products of corrosion are retained in solution, and therefore no mechanical method of removing the oxide in order to determine the iron content is necessary. Then there was a new photometer for use with light emitted from a gas mantle. A caesium cell is employed in such a way that deflections of a pointer are obtained and which are directly proportional to the candle-power. It has been calibrated in accordance with the spectrum of light emitted. We may mention that the General Electric Company, Ltd., showed a model of a photo-electric street lighting unit, so designed that, as daylight fails, lamps are automatically illuminated. The apparatus is being tested practically in a street at Wembley.

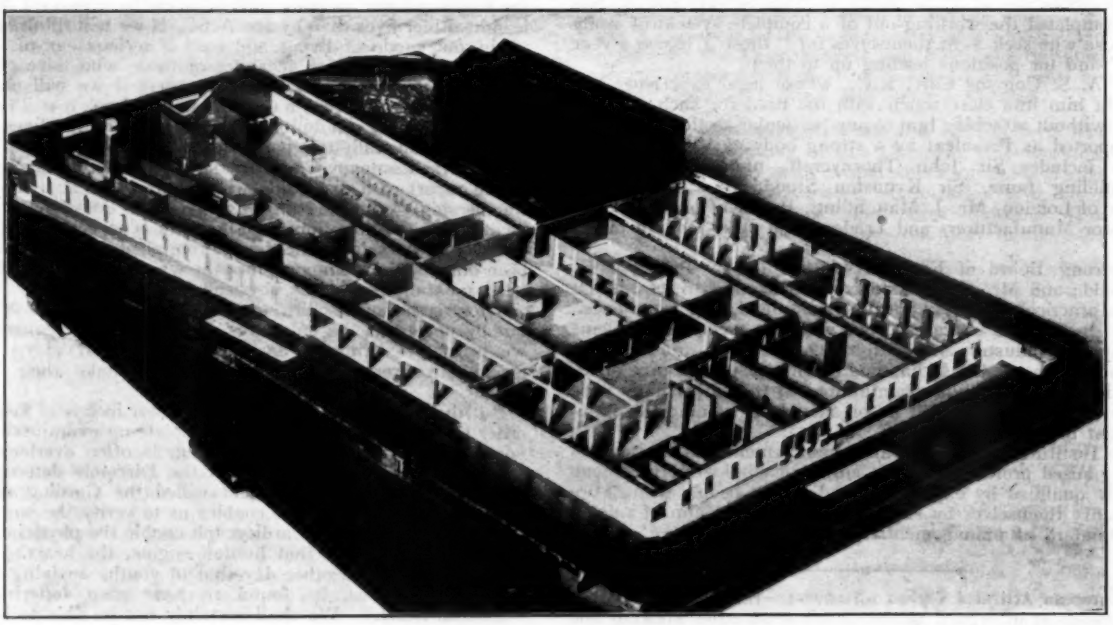
An instrument which permits an indication of gas pressure to be transmitted electrically to a distant point was shown by Messrs. George Kent, Ltd. The readings are given to within 1/10th in. water gauge, and there is an arrangement whereby the live wire resistance may be accurately compensated for before each reading is taken. In addition to many types of recording pyrometer, the Foster Instrument Company exhibited a surface heat-loss gauge which gives a direct reading of the heat loss from furnace walls, &c., and avoids the laborious calculations incidental to arriving at figures by means of surface temperature thermometers. This gauge was demonstrated, as also was an automatic temperature control apparatus. The latter is essentially a recording pyrometer in which the periodic depression of the pen arm, to produce the record, is made to open and close appropriate relay circuits to control the temperature of a furnace, the temperature being at the same time recorded on a chart.

The exhibit of the Cambridge Instrument Company, Ltd., included a number of instruments for industrial purposes, such as pyrometers, thermometers, gas analysis apparatus, draught and pressure gauges, automatic regulators, and galvanometers.

The Thermal Syndicate, Ltd., showed many applications of "Vitreosil" pure fused quartz, while the Electroflo Meter Company, Ltd., demonstrated automatic temperature control and a motor-driven carbon dioxide recorder and transmitter. The latter instrument is particularly applicable to the measurement of the proportion of carbon dioxide in flue gases.

Before terminating this note, we must mention the apparatus in the historical section of the exhibition. This was selected to illustrate experiments of historical importance on the determination of the mechanical equivalent of heat, and some points in the evolution of thermometers. The thermometers included reconstructions of the earliest known instruments for demonstrating the expansion of air by heat, and the thermoscopes described by Philo of Byzantium (300 B.C.) and Hero of Alexandria. There was also a photograph of Galileo's thermoscope.

Leeds Inaugurates Extensive Distribution and Street Lighting Workshops.



MODEL OF THE NEW DEPARTMENT, WITH ROOF REMOVED, SHOWING THE ARRANGEMENT OF THE WORKSHOPS.

The extensive new buildings of the Distribution and Street Lighting Sections of the Leeds Corporation Gas Department were officially declared open on Jan. 6 by the Lord Mayor of Leeds (Councillor N. G. Morrison), in the presence of a large gathering of representatives of the gas industry and of neighbouring gas authorities.

The new workshops take the place of the former workshops in Swinegate, and co-ordinate phases of work formerly carried on under separate roofs at Sovereign Street, Springwell Street, and the Meadow Lane Gas-Works. The Leeds Gas Department lights over 600 miles of roads every night. Statistics for the year 1928—the latest figures available for a complete year—show that there were in that year 18,254 street gas lamps.

AN INTERIOR VIEW OF THE NEW WORKSHOPS AT LEEDS.

More than 17,000 of these are already working under automatic clock control, and the remainder will be brought under the system as convenient. In the same year there were 72,318 automatic meters and 61,828 ordinary meters. The revenue of the Leeds Gas Department for the working year ended March 31, 1929, was over £750,000.

RE-CONDITIONING OF COOKERS.

The visitors to the new workshops were taken through the main general store, a very large building, along the corridor through which, the whole length of the building, runs a conveyor platform, let into the floor, travelling at the rate of 40 ft. per minute, and collecting or depositing goods at any point desired. The conveyor begins at the extensive loading docks at the far end of the building, where wagons bring in meters, cookers, fires, &c., for testing, repair, and renovation, or for dismantling. The visitors saw dumps of cookers in rusty and grease-covered condition, and were shown these and other appliances passing through the processes of washing, bathing in caustic soda, reconditioning in every way, and eventually repainting or plating, and turning out as second-hand articles looking and working almost as if new. The big general store, the cooker and fire renovation shop, and the meter shop, are all very roomy, with a foreman's office in the centre of each shop, giving him a complete view of the whole area under his charge. The foreman in each case also has control, by switches, of the excellent steam heating system and electric fans and ventilation system for removal of gas fumes through roof outlets.

METER TESTING.

The visitors were shown the testing and repair of street lighting control clocks, meters, &c., including dark rooms for gas-testing of meter-cases for pin-hole leaks, and for finding pin-holes in meter diaphragm leathers. The magistrates' testing room was also inspected with great interest. In the meter shop, it was seen that all the sheet metal work for the whole department is done.

The new workshops are equipped with their own automatic relay telephone installation. The receiving dock on the Regent Street frontage of the building accommodates twelve wagons at a time, and the despatch dock on the Gower Street side ten wagons. In the general offices the visitors were shown the card index system by which the history of every gas appliance is on record, from the issue by the maker, through its use by the consumer, its return for repair, testing, or renovation, up to its final dismantling.

The buildings themselves are on the most up-to-date lines. They have a concrete base and comprise a steel frame filled with pressed bricks. The roofs are very generously glazed to give plentiful natural lighting, and ventilation is by means of large Robertson ventilators in the roof. The workshop floors are hardened to prevent dust and wear, and the office floors are of wood blocks. Artificial lighting throughout is by low-pressure incandescent gas.

The Lord Mayor was accompanied by the Lady Mayoress, and the party assembled in the large entrance hall, of which the main doors are in Bridge Street. In addition to declaring the new workshops open, the Lord Mayor unveiled a handsome commemoration tablet—the work of Mr. James H. Thompson, of Leeds—in bronze and vitreous enamel, mounted on oak. The tablet bears—beneath the Leeds City Coat of Arms, in correct heraldic colours—the names of the Chairman and members of the Gas Committee; the Town Clerk (Mr. Thos. Thornton); the City Gas Engineer and General Manager (Mr. C. S. Shapley)—this year's President of the Institution of Gas Engineers; the Architect (Mr. George W. Atkinson); and the contractors (Messrs. J. H. Wood & Co., Ltd.).

Councillor E. J. CLARKE, Chairman of the Leeds Gas Committee, presided over the brief ceremony, and the gathering included the Deputy Lord Mayor (Councillor C. V. Walker), three ex-Chairmen of the Gas Committee, and ex-Lord Mayors.

The CHAIRMAN (Councillor Clarke) said the day's proceedings marked a very important step in the progress of the Leeds Gas Undertaking, for in these new workshops—which covered some four acres of land and housed some 460 men—they had what might well be called the very hub of the service offered by the Gas Department, though, of course, he fully recognized the claims of the various gas-making works themselves in that respect. It was here that all the equipment of the distribution service, the meters, fires, cookers, &c., was centralized; it was here that the vast numbers of meters and appliances were tested, repaired, and renovated, where old appliances were rejuvenated to be sold second-hand, almost as good as new. Apart from the ordinary domestic service appliances, it was within these walls, also, that all associated with street lighting service and maintenance was now housed. Leeds had over 18,000 street gas lamps—a very big undertaking in itself. Out of those 18,000 street lamps, some 17,000 were on the automatic clock control system, and in the new premises they had full equipment for testing these clocks, as well as meters, cookers, fires, and other appliances.

The LORD MAYOR said the new buildings were undoubtedly a very great step forward in the progress of the gas industry so far as Leeds was concerned. It was as long as 112 years ago that Parliament gave statutory powers to the old Leeds Gas and Lighting Company to produce gas at the York Street Works. At that time rather less than 10 million c.ft. of gas was sold per year. To-day, one works alone of those of the Leeds Gas Department—that at Meadow Lane—could produce the same quantity of gas in a day.

The Lord Mayor said he was glad of the opportunity to pay his tribute to the skill and esteem in which was held the Leeds City Gas Engineer, Mr. C. S. Shapley, who had brought honour to Leeds by his election some years ago as the President of the Institution of Public Lighting Engineers, and now by his election to the Presidency of the Institution of Gas Engineers.

Alderman GEORGE RATCLIFFE, former Lord Mayor and ex-Chairman of the Gas Committee, proposed a vote of thanks to the Lord Mayor for his presence and for declaring the new building open.

Alderman NOON (Deputy Chairman of the Gas Committee), seconded the vote of thanks.

Mr. GEORGE W. ATKINSON, the Architect, in proposing a vote of thanks to the Chairman, said the lay-out of the new buildings was very largely a matter to the credit of Mr. Shapley.

London Juniors Visit Wandsworth Works.

A large gathering of members of the London and Southern District Junior Gas Association assembled at the Wandsworth Works of the Wandsworth, Wimbledon, and Epsom District Gas Company on Saturday, Jan. 11. Before the inspection of the works, luncheon was provided for the visitors at the kind invitation of the Directors of the Company.

The visitors were welcomed by the Chief Engineer and General Manager, Mr. C. M. Croft, M.I.Mech.E., F.C.S., and the following guides conducted them round the works: Messrs. E. Rees (Assistant Engineer), U. O. S. Nairne, M. C. Lemoine, G. Gardiner, R. Farror, F. W. Robinson, C. Bale, and E. Warren.

DESCRIPTION OF THE WORKS.

The London Juniors last visited these works in 1926, when a description of the works was given in Vol. 173 of the "JOURNAL." Many new features have been incorporated since that date, particularly, of course, the construction of the "C.O.L." chamber ovens, a detailed description of which, by Mr. Croft, together with operating results, appeared in our issue for July 31 last.

Gas was first supplied from the Wandsworth Works in 1834. The original site occupied less than one acre; to-day the works cover an area of over 26 acres, and have over a quarter of a mile frontage on the Thames. The whole of the coal requirements for the works are carried by a fleet of specially-constructed colliers, which, on arrival at Wandsworth, moor alongside one of the two crane pontoons in midstream, where they are discharged at the rate of over two hundred tons an hour into floating barges of various types. When full, the barges are floated to the land discharging gear connected with one of three coal stores, where the coal is dealt with by grab cranes discharging into gravity bucket conveyors capable of filling the stores, trimming the coals as required, or, in case of fire, of removing them from one place to another without manual labour. One of the Company's boats, the s.s. "Ewell," is the largest steamer at present navigating the Upper Tidal Thames.

The Wandsworth Works are equipped with three retort houses. One is of special interest, as on the site of the old No. 1 bench is erected the installation of vertical chamber ovens, supplied by Gas Chambers and Coke Ovens, Ltd., of Westminster, S.W. 1, in 1928. Up to the present this plant has worked continuously for 560 days, and carbonized nearly 100,000 tons of coal.

Briefly, the installation consists of five units of six chambers each, having a productive capacity of 3 million c.ft. The chambers are constructed of silica tongued and grooved blocks, have a cross-section of approximately rectangular form with rounded corners, and sides slightly cambered. There is a uniform taper throughout the height of 20 ft., the average width is about 10 in., and the average breadth about 9 ft. The plant is provided with external gas producers, and consists of two Lymm-Rambush patent mechanical grate units, with automatic ash discharge, and designed to gasify 15 tons of fuel each per diem. Waste-heat boilers are provided through which the hot producer gas passes after leaving the producers. Cool and clean producer gas is supplied to the plant by a 24 in. steel main; separate cast-iron valves with adjustable scales being provided for each of the groups of combustion chambers.

The chambers are charged from the top through charging ports provided, and are fitted with suitable cast-iron self-sealing covers. The present capacity of this house is 5 million c.ft. per diem, but on completion of the second installation of chamber ovens the capacity will be raised to about 9 million c.ft. per diem.

The streams of gas from the several retort houses meet in one collecting box, and prior to admission to this box are regulated by means of "Arca" regulators. The regulators are a corrective for vacuum, and suitable testing apparatus is provided for each stream to enable the gas to be continuously tested as it is being produced, and governors regulated as the requirements demand for quality. The finished gas from the outlet of this box is continuously tested by means of a jet calorimeter and a recording calorimeter, and again by a "Sigma" recording calorimeter and a Simmance-Abady recording calorimeter after purification and inclusion of the stream of water gas.

There are four C.W.G. units, two each of 800,000 c.ft. capacity per diem, and two each of 2,250,000 c.ft. capacity per diem. The total capacity is equivalent to 6,100,000 c.ft. per diem. The two larger units are housed in a spacious building, and these units are of the latest type Humphreys & Glasgow plant, with self-clinkering generators and hydraulic coke dischargers. The plant incorporates the three-phase cycle back-run process and is operated accordingly. The blue water gas is carburetted to produce a gas equal to 470 B.Th.U.

A new water tower has recently been constructed of reinforced concrete throughout, which will materially augment the existing water storage capacity.

Tar dehydrating plant is of the "Cascade" still type, and has a capacity greater than the present requirements of the works. This type of plant is flexible and the outlet tar can be simply regulated to any Road Board Specification.

The visitors were interested in the plant which has been provided for emergency work on the district. It consists of two "Lacy-Hulbert" petrol-driven compressors, complete with fittings. It was noted that one unit was mounted on a six-wheel "Ford" chassis, and the other on a trailer specially constructed to accommodate the set. Each set will provide sufficient power to drive two road-breakers, and the hose connections are arranged so that work can be carried on from each side simultaneously.

The new offices were also inspected by the Association. These are an extension of the Chief Engineer and General Manager's Office, and provide accommodation for the whole of the Sales and Distribution Officers and Staff, as well as the Accountant's Staff.

After the inspection of the works, the visitors were entertained at tea at the invitation of the Directors of the Company. At the conclusion of tea, the Association gathered in the new offices, where they were addressed briefly by Mr. C. M. Croft, Chief Engineer and General Manager of the Company.

Mr. CROFT said that he had great pleasure in welcoming the Association once more to Wandsworth, on behalf of the Directors and Staff of the Company, and he hoped that they had had an interesting visit, and seen all they wanted to see. They were delighted to see such a large attendance at the works that afternoon.

The PRESIDENT (Mr. F. S. Larkin) remarked that he was sure that the gathering was indicative of the interest taken in the Wandsworth Works by the Association. It was only four years since they were there before, but the progress they would have noticed to have taken place in that time was remarkable. The first thing they had probably seen on entering the works was the "Chaseside" lifter, which had only been evolved during the last few years, and was notable for the saving of cost in its use. He also referred to the new chamber ovens, saying that the majority of the Association had probably not had the opportunity of seeing ovens of this description before.

Mr. T. H. PRATER (Margate), Senior Vice-President, in proposing the very hearty thanks of the Association for the hospitality of the Wandsworth Company, said that this visit had certainly been unique, and they much appreciated the opportunity of seeing the chamber ovens in action. This system had the advantage of using clean producer gas. The operating methods of the system were considerably simplified, and the sensible heat of the producer gas was utilized for steam raising. They had noticed that there was no waste-heat boiler in the usual sense of the word, but their steam generating plant seemed very efficient indeed. Mr. Prater went on to refer to the report recently made by the Chief Engineer of the Company on the working of the chamber ovens, and said that they would find this very interesting reading. In conclusion, he said they were glad to see in connection with the chamber oven plant that the Company were laying down the foundations for another similar plant. He thanked the Directors on behalf of the Association for the hospitality extended to them that afternoon.

Mr. J. H. GOLDSMITH (South Suburban), Junior Vice-President, in seconding the vote of thanks to the Company, said he would also like to associate the names of the guides who had so ably conducted them round the works. He commented upon the advantages of the Babcock boilers, particularly their ability to burn all kinds of rubbish. He was sure that they were all favourably impressed with the very neat lay-out of the works. He was pleased to hear that the vacuum control which they had seen in their previous visit in 1926 was still giving every satisfaction.

Mr. G. S. GADSBY (Gas Light and Coke), who was once with the Wandsworth Company, said how much he had appreciated re-visiting his old works that day. They were greatly indebted to the Directors for their hospitality. He went on to recall how he had commenced his association with the gas industry in these works as assistant to a foreman fitter. It was at these works that he had gained that technical and practical knowledge which had stood him in good stead ever since. He recalled how he had passed the first automatic meter and handled (at first unsuccessfully) the first incandescent mantles in that Company's area. He concluded by saying that the visit had been of educational value to them all, and he was pleased to associate himself in the very hearty vote of thanks to the Directors.

Mr. CROFT, in reply, said that Mr. Prater had mentioned the extension contemplated in regard to the chamber oven plant. This new plant would be a standard extension to the first bench. They were making very considerable advances in their methods of coke discharge, and the Association would find many alterations in this regard when they paid their next visit. Previous speakers had pointed out many of the good features of the works, but he observed that they must have noticed two distinct faults. These were the stores and the stove shops. They were already getting out the designs for the new stove shops, and the present stove shops would be converted into stores.

Mr. E. REES, on behalf of the guides, said he would like to thank the Association for what had been said in connection with the guides. He assured them that it had been a very great pleasure to take them round the works.

Coal Cleaning in Modern Times.

By Dr. R. LESSING.

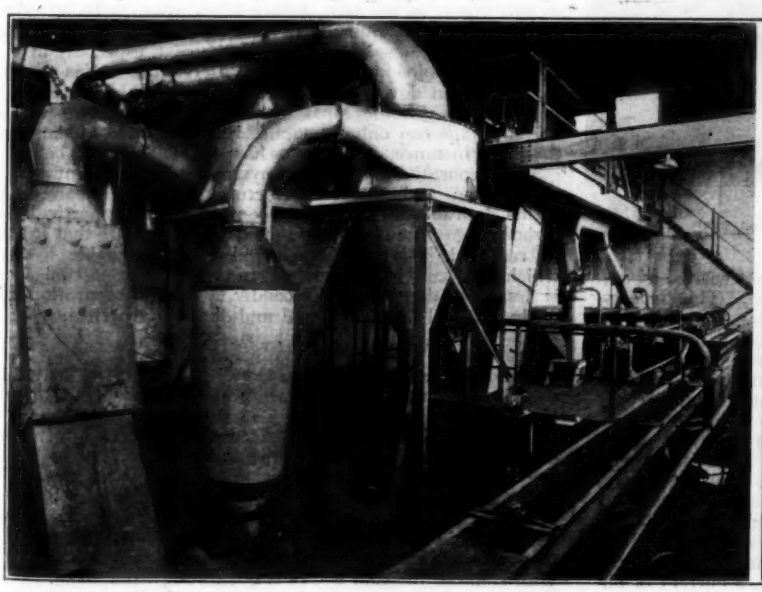
[From a Lecture before the Southern Association of Gas Engineers and Managers (Eastern District). It is recorded here following suggestions made at the meeting that it was of such importance as to warrant greater publicity.]

The question of cleaning coal is one of the most important, if not the most important, concerning the gas industry—and, in fact, all coal consuming industries. Whatever ash and impurities are contained in coal supplied to gas-works are bound to make themselves felt in the products, at any rate in the coke; and there are certain influences on the quality and quantity of gas made. The importance of this question, and the appreciation of its importance, have been growing very much during the last few years. Recently, Sir David Milne-Watson, in his Presidential Address to the Institute of Fuel, discussed the absolute necessity of having clean coal supplied to the gas-works by the collieries.

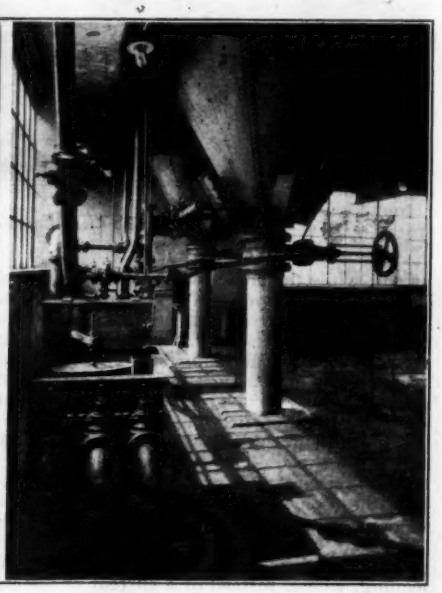
Coal does not contain a uniform kind of ash, homogeneously distributed throughout the coal substance. There is hardly any British coal having more than 3 or 3½ p.ct. of ash in the true coal substance. A vast preponderance of British coals have ash contents ranging from 1 to 2½ p.ct. In Yorkshire you get an appreciable proportion having 1 p.ct. or under in the true coal substance. How is it we get coals delivered which are considered good with 8, 9, 10 p.ct., and possible exceptions coming down to 7 p.ct.? The bulk of this ash is due to the mechanical admixture with the coal of materials which are not coal. They can be classified in two categories. First of all the majority of the ash-forming materials are shale and pyrites—calcium carbonate and iron carbonate are also included to a certain extent. This shale, of course, is usually carbonaceous, and has a certain amount of a kind of coal substance distributed throughout it. But it is rather different from the true coal substance. The latter, as we know it to-day, can be classed into four different groups. There is the coking portion, which is composed of the two kinds, vitrain and clarain, the bright, lustrous portion of the coal; and the other is durain, the non-coking or feebly-coking substance, the hard dull variety in the coal. Then we have a fourth substance called fusain. This is the charcoal-like powder, the very friable material which is interspersed in the coal seam in little lenticles and very thin sheets or veins—not going throughout the layer, but disposed in small pockets. It is like charcoal; it is what used to be called mineral charcoal or mother of coal. Strange to say, it is the only substance in coal which soils the fingers. It is present in most coals not exceeding 5 p.ct., and it may be hard to believe that the bulk of coal, to the extent of 95 p.ct. or so, does not actually soil your fingers.

Fusain, the charcoal-like substance which is always present in coal, is the component which forms the dust. It is non-coking; like charcoal, it has no caking power whatever, and therefore remains unchanged even in the coke. If you break a piece of coke, or touch coke from the outside and get black fingers, you may be certain you have struck a little pocket of fusain. It gives no gas to speak of, and does not form what is truly called coke. Fusain usually contains a comparatively high percentage of ash, from 12 to 15 p.ct. It has been deposited in the coal, by infiltration of water throughout the seam. Its ash is composed of calcium carbonate and iron carbonate, like boiler scale, with a little finely divided clay throughout the deposit. This ash is absorbed in the porous material, and cannot be extracted mechanically afterwards.

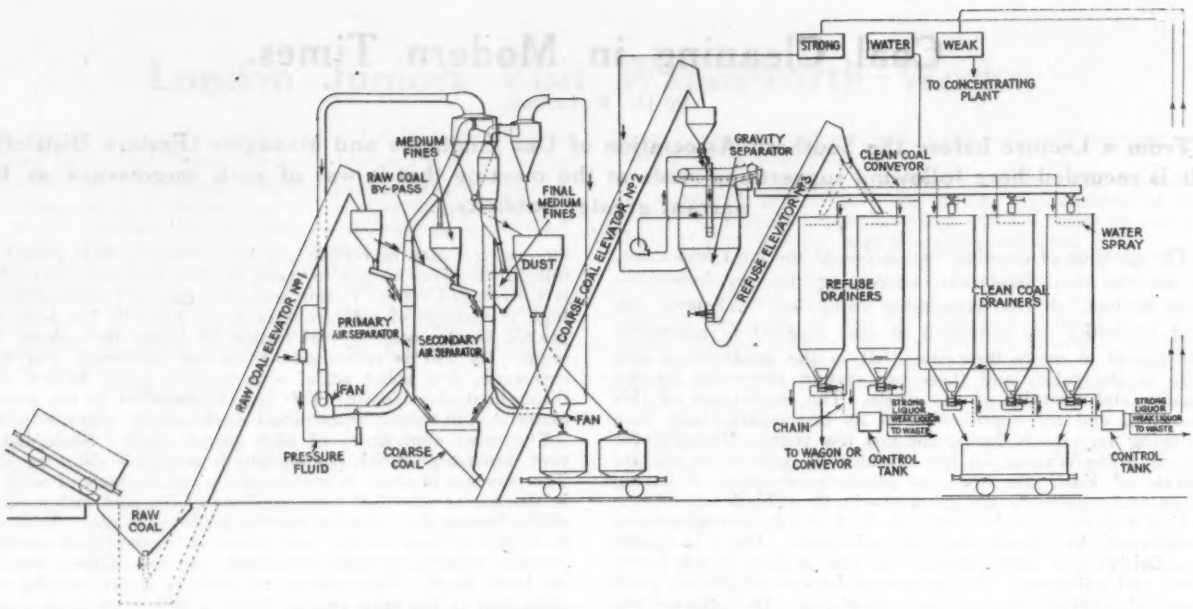
The other contributor of high ash is shale. Shale has a very much higher ash percentage; it averages about 75 p.ct. The presence of shale in coal is due to the methods of mining, in the course of which some portions of the roof and portions of the floor of the seam accidentally get into the coal. It cannot be helped in hand mining, and is almost impossible to avoid in machine mining as done nowadays. In my opinion there is no harm in it. The colliers are usually under penalty and obligation to the mine management to deliver as clean a coal as possible. If this is done they cannot help leaving coal underground, and to-day still an appreciable percentage of clean coal is left underground. We have to think of methods of eliminating high ash forming material. This is usually done by washing. In dealing with unscreened run-of-mine coal, the ash percentage (and therefore the contribution of the impurities mentioned) varies according to size. You get large lumps of coal in certain districts, from 12 to 18 in. or more, comparatively pure; and the reason they are large is that they are pure—because the impurities form lines of weakness throughout the coal seam, and when the coal is handled and roughly handled, as it is bound to be going over screens, being jolted along in tubs, and so on, it breaks along those lines of weakness formed by the impurities, and allows the impurities to drop out. The large coal which does not break up like this is therefore one which does not contain those impurities, at any rate to the same extent; and the preference of the buyer in the past, and even to-day, for large coal is not so much due to the size as to the implied guarantee given by that size that the coal is pure. In lieu of doing an ash analysis, the old buyer said, "If I get large coal, it is comparatively pure." He knew this by experience empirically; and it is in some way unfortunate that this large coal led us to design all our coal consuming appliances—particularly boiler and furnace grates—for large coal. But there is now a distinct tendency, which is bound to be increased and intensified during the next few years, towards smaller sizes for everything. We have learned in carbonizing in gas-works to use smaller sizes of coal, and they will get smaller still, certainly in boiler firing and furnace firing in general, until we come down to powdered fuel. This is all important as showing that, while large sizes are comparatively pure, as you get smaller you



Top of De-Dusting Plant and Gravity Separator.



Bottom of Refuse Drainers, showing Discharge Chutes and Liquor Control Tank.



DIAGRAMMATIC ARRANGEMENT OF CLEAN COAL PLANT.

come down to the higher ash content, due to the mechanical admixture of shale, pyrites, and other impurities. When you hear of ash percentages of 15, 20, or 25 p.ct. in coal, this always means the average ash content; and it is rather strange that to-day we find that the higher the average ash, the cleaner the coal substance. Therefore, the smaller sizes give you really cleaner coal than (say) nuts or even the large.

I am not going to speak of the previous attempts that have been made for purifying coal by washing, and lately dry cleaning, except to say that what was done was not for domestic purposes. It was particularly small coal, which was used in the first instance for coking purposes, where a low-ash coke is required for metallurgical purposes, and where the need is much more pressing than it has been hitherto in the domestic market. But in the domestic market I feel quite sure it is coming very rapidly. Coal is washed to-day by placing it into a current of water where the velocity of the current is so adjusted that the coal, which is lighter, is carried up by the

Top of Gravity Separator and Clean Coal Conveyor.

current, while the shale, which is heavier, is not carried away, but sinks. There you get a certain separation. This separation, however, is comparatively rough, because, according to the laws of particles falling or carried in water, there are two factors involved—one being size and the other gravity. It is therefore not only a question of specific gravity, but the size factor comes in to a great extent. This means that a comparatively large particle of clean coal goes in the same direction in the current of water as does a comparatively small particle of shale. The two go together the same path, and cannot be separated from each other. It always struck me that, while these physical laws obtain it is absolutely impossible to get down to what I knew was the true inherent ash content of the coal, because you have these two factors at play. Similar considerations apply to the case of the more modern dry cleaning, where, instead of a current of water, a current of air is employed, and where (air not having the carrying capacity of water) these differences are even more accentuated.

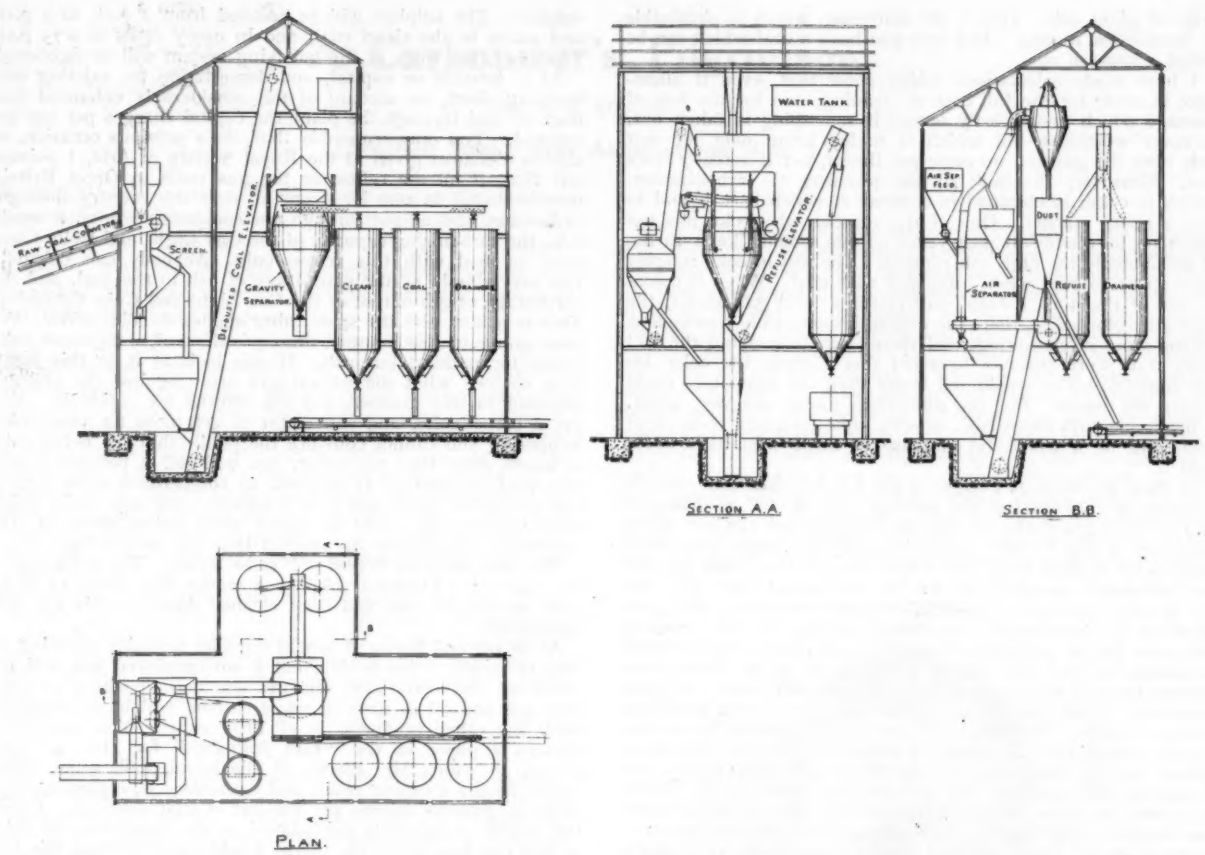
Float and Sink Test.

In order to test the efficiency and the performance of ordinary coal washing, and in order to test the coal originally, in regard to the various pure portions and impurities, we have been using for many years what is called the float-and-sink test. A sample of coal is put into a bath of a liquid, the specific gravity of which lies just between the specific gravity of coal and that of shale. The specific gravity of the liquid (calcium chloride) is about 1·4, while that of the coal is 1·3. The impurities, shale and pyrites, have a specific gravity of over 2; so you have here a wonderfully simple means of separating by one single natural law the impurities from the clean coal substance. The factor of size is absolutely excluded. You can imagine that a lump of coal, however big, having a mean specific gravity of 1·3 would float, while a lump of shale, however big or small, would sink. Knowing this, it occurred to me many years ago that this ought to be applied on the large scale. But I considered it for many years very difficult or impossible from the point of view of practical engineering, particularly chemical engineering. A number of factors came in which made it seem almost impossible of adjustment. However, I took my courage in my hands, and started working on it; and straightaway one important difficulty presented itself. You have in the ordinary coal a quantity of fusain, the mineral charcoal, and together with it some other very fine dust—I am speaking here of dust smaller than (say) one-hundredth of an inch. Now it is obvious that, if such a process be carried out—(say) with calcium chloride, which is the cheapest material giving the requisite specific gravity—after the separation is effected the calcium chloride must be removed again. In coke ovens, as you know, in the past, before silica ovens were introduced, there was a great difficulty in keeping the ovens from slagging on account of the salt contained in the coal, especially in Yorkshire. It is obvious that the calcium chloride has to be removed, or cut down to very small limits. In order to do this the calcium chloride must be drained out and washed, and this drainage can only be obtained if we get rid of the dust in the first instance. The dust has to be removed before the gravity separation, and as it anyway is of a different chemical composition and physical structure from the clean coal, it seems desirable also from the commercial side, particularly in carbonizing—because it is a non-coking material—that it should be removed. The only commercial way available to-day in which coal can be cleaned down to its inherent coal content is first by de-dusting, and secondly by gravity separation of the de-dusted coal into clean coal and shale and pyrites.

Large-Scale Plant in South Wales.

The question is, How is it done? I cannot do better than explain a plant in which the process is carried out to-day in South Wales. I ought to say in the first instance, as to de-dusting, that in the beginning I considered for a brief moment screening the coal. But when you come to consider that we are dealing here with dust particles under one-hundredth of an inch in diameter, you will find that it is commercially out of the question. The screens would clog up very quickly. There would be a small throughput, and the dust would not be completely removed. It would travel over the screen along with some of the coal before it got through the mesh.

The next thing was to do it pneumatically, in a current of air. Several systems then in existence were tried and found



CLEAN COAL PLANT FOR TREATING 75 TONS PER HOUR OF COAL, SIZE 1 IN. TO 0 IN.

wanting, and a solution had to be discovered. It is very simple, works absolutely dust-proof in big quantities, and can be applied to any coal. The coal comes up through an elevator and a feeder and is introduced in a pipe system. The coarse coal drops down a tube. There is a fan which blows the air in an upward direction. The velocity of the air is so calculated that it just removes the dust, and nothing but the dust. The latter is carried up and deposited in a cyclone, and the de-dusted air, carrying still a little of the very finest dust with it, returns to the fan. It is all done in a closed cycle; the dust deposited in the cyclone being taken to the dust bunker, and the de-dusted coal to another bunker. The dust must be fine enough to be used directly in connection with coal dust firing. This seems to be the only reasonable and rational way to which this fuel should be put, because it is non-coking, and would be too fine for firing on mechanical stokers. For coal dust we have to-day very stringent specifications of size, and it must be very fine indeed. The bulk is required to go through a screen of two hundred mesh to the inch. In order to get this we take out a middle product, which is a mixture of the smallest coarse and coarsest dust, into a little bunker feeding into a secondary separator in which the process is repeated. The coarse material falls down into the de-dusted coal bunker; the dust is taken out in a smaller cyclone, from which it drops with the other dust into the dust bunker, and is put into specially constructed tank wagons—which were, I may say, the first tank wagons to carry coal dust on British railways. We have in the coarse coal bunker the de-dusted coal, coarse coal free from dust. Free from dust is almost literally true, because in this very simply way of blowing it with air we reduce the dust content from 20 or 25 p.ct. to 0·5 p.ct. You can realize there is no more of the trouble about slurry formation that you have when the bulk of the dust is there as in this cylinder. You get clear solutions.

The coal is passed up the second elevator into the gravity separator. This is a vessel filled with calcium chloride to the brim. Coal is introduced half-way down. The shale and heavy impurities sink, are carried up by the refuse elevators, and put into one of two drainers. The clean coal rises, floats, and is taken over by a push-plate conveyor on to another conveyor, from which it drops down into the clean coal drainers. In these drainers the clean coal and refuse is washed with water for removing the calcium chloride. The draining-out of the calcium chloride solution, which is very viscous and heavy, and the final washing-out of the last traces of chloride, and draining away of water, are done by a process of methodical displacement. The water is put on top of the charge, and the heavier calcium chloride solution runs away from under the water; the water following all the time. By doing this only a very narrow layer of diffusion is formed, where the calcium chloride goes into the water and the water into the calcium chloride. There a small amount of weak liquor is formed, but the bulk of the solution is recovered in its original strength and re-circulated throughout the system. The smaller amount of weak liquor is sent into an ordinary evaporator and brought back to the required strength for the gravity separation. By reason of having de-dusted the coal, the drainage is done to such perfection that the whole process is completed in a very few hours. While in to-day's washery practice at coke ovens and collieries draining takes from 24 to 36 hours, and gives a slack containing, if it is well done, 15 p.ct. of moisture, in this apparatus draining can be done in a layer about 35 ft. deep in from 1½ to 2 hours, down to a free moisture content of from 1·5 to 2·0, or at the utmost 5, p.ct. This is entirely due to the completeness of the dust removal. The coal obtained in this plant actually contains no more than 1½ to 2 p.ct. of ash; and this is done quantitatively to the extent that all the coal of this lower ash content present in the raw coal is collected together as the clean coal. There is no question of even a particle of coal of the light gravity going over into the refuse, or a particle of the refuse ever getting into the coal. Any carbon in the refuse is the natural constituent of carbonaceous shale; but there is no loss of coal in dirt of any coking value.

Significance to the Carbonizing Industries.

If we do an ash test on the average sample of raw coal, we get some nondescript mixture of ashes, which, if we examine it in the ordinary way by chemical analysis, will not tell us very much. On the other hand, after splitting the coal into its three rational components, each one has an ash vastly different from the two others. I can hardly go into the chemistry of it or explain the difference in constitution. Generally, the dust contains carbonates, something like boiler scale, due to water infiltrated into the coal seam and into the porous fusain. The refuse mainly consists of clay substance together with the pyrites. The ash in the clean coal is mainly the original plant ash.

Then comes the question, Does coal cleaning pay? Even to-day those gas-works which are using clean coals are not always clear whether it pays them to do so, on account, possibly, of the higher price charged for the cleaner coal. I would not like to be too assertive as to whether it pays or not where an indifferently cleaned coal is concerned, because the ash is not reduced to a minimum. There is still some of the dust ash and some of the shale ash present, on account of the two factors involved in the ordinary washing process. Where, however, one makes absolutely certain that the whole of the shale and the whole of the dust are removed, there is only one kind of ash—that is, the inherent ash in the coal, the

original plant ash. This is the minimum which is obtainable by mechanical means. And then you have a coal which can be called a low-ash coal.

I have made calculations which show that, even if allowance is made for the full cost of cleaning, and for the loss of tonnage which undoubtedly occurs if something is taken out, however worthless—but which is to-day being paid for—not only does the gas cost no more per therm, but it actually costs less. Moreover, the bulk of the products of carbonization, which is coke, is obtained in a form in which it is bound to find a ready market. One of the reasons why coke has not taken on as readily in past years as one would like it to do, is undoubtedly the high ash content. The ash in coke roughly goes up by 50 p.ct. when compared with coal. When it comes to one of the most natural outlets for a local gas-works, the domestic coke boiler, there the difficulties are really tremendous on the score of clinkering, and there is no gainsaying the fact that, if it were possible to avoid this clinker, the coke for the domestic boiler would sell faster than the companies could supply the needs. But the difficulties to-day are very great. A fire made with clean coal, or with coke produced from clean coal, will be a wonderful surprise to those who have never seen it.

In these calculations I ought to say I have taken into account the cost of coal—taking the average cost of coal as delivered to a London gas-works by sea, the cheapest one can get, or as cheap as a big London gas-works buy it to-day—and compared with it clean coal, into which the cleaning costs per ton are calculated (roughly ¾d. for the de-dusting side, 4¾d. for the gravity separation, washing-out, and everything else, and allowing for another 2d. for capital charges on the cleaning side, and ¼d. for contingencies). You can clean a ton of what is considered bad coal to-day—I am speaking of slacks containing from 15 to 20 p.ct. of ash—and get every ounce of truly clean coal out of it at the rate of 8d. per ton of coal, including capital charges. The dust is taken out and assessed at a low figure, though there is plenty of scope for it in the Newcastle power stations and other works in that district which use powdered fuel, and pay 3s. per ton for grinding the slack, or, rather, the shale and impurities in that slack, which account for the bulk of the maintenance costs of the milling arrangements to-day. Powdered fuel would have made very much more headway but for the enormous difficulties encountered in connection with the grinding, and the tremendous wear and tear on the mills through the impurities in the coal.

Having taken cleaning costs into consideration, we then come to the gas-works process. I assume that you get a good yield—(say) 72 therms per ton—from the ordinary gas coal. The amount of clean coal required to make 72 therms is obviously smaller. One only needs 95 p.ct. of a ton to get the same gas as out of a ton of ordinary gas coal. This means a saving, but it does not wipe out the extra cost per ton of the clean coal. Coal delivered in London to-day costs not less than 26s. per ton from the pit into the retort house, while the clean coal would be over 28s. per ton; but, as you want less of it, you straightaway have a reduction.

Then comes the great point of the retort house fuel. To-day we want high gas yields, which involve high temperatures in the combustion chambers. In order to get the high temperatures, we cannot help forming clinker in the producer. Not only clinker, but, on account of the clinker—which requires removing, handling, and disposal after it is removed—while we are forming clinker, the gas generation in the producer becomes very irregular. It never remains constant in quantity or composition over a period of hours. As the clinker bed forms, so the quality of the heating gas deteriorates. The stand-by losses for cleaning out are very considerable. I have not taken a great deal for the higher efficiency claim, but have simply put in the extra fuel required where you have dirty fuel, and the smaller amount of fuel required where you have the cleaner one. You have to consider in the one case that you deal with a coke containing something like 12 p.ct. of ash, while in the other case it would be only 4½ p.ct. of ash. You can imagine, from the practical point of view, what it means to run your producers on such an ash percentage. There is a saving on account of the higher calorific value and cleaner coke, and (say) 10 p.ct. for efficiency, of retort house fuel. Carbonizing charges are lower, because there is less tonnage to handle. Purification is cheaper, because there is less sulphur. The sulphur will be reduced from 2 p.ct. to 1 p.ct. and under in the clean coal, and in many cases to 0·75 p.ct. Therefore, the work of the purifying system will be lightened.

As to interest on capital, and depreciation for existing carbonizing plant, on account of the considerably enhanced tonnage of coal through the plant the capital charges per ton are reduced. You may remember that, on a previous occasion, in Cantor Lectures given at the Royal Society of Arts, I pointed out that, if all the refuse in the gas coals in Great Britain were collected in one lot—from all over the country—brought to London, and all put through one company's works, it would take the carbonizing capacity of the Gas Light and Coke Company to deal with this refuse only. Anybody can calculate this very simply by the percentage of ash in the coal, and the percentage of gas output of the Gas Light and Coke Company. That is a fact, and the same thing applies to coke ovens. We keep going in this country the equivalent of a thousand coke ovens for nothing but ash. If you look at it in this light, it is obvious what the advantages are. Against the charges adjusted in this manner, put the returns for residuals. You get a better coke, and you ought to get more for your coke. Supposing you cannot convince the public that the better coke is worth more than the other, you will sell it because it is a nice fuel to handle. It will sell in competition with anthracite and other fuels, and it will balance your gas make much more neatly. You will be much more independent of the superfluity of coke on the market than you are to-day.

The percentage of breeze will come down. The reduction in the case of a Durham coke oven works was from 13 to 2½ p.ct. where the coal had been cleaned down to this low ash percentage.

As to tar and liquor, I would not like to claim anything by way of money value to-day, but I am convinced you will get more tar and better tar, and get less decomposition of valuable gas and tar in form of retort carbon, which, as compared with the other products, is of little value. You may have noticed a paper in the "GAS JOURNAL" for Dec. 4, 1929, p. 653, in which Mr. Plevin, of Blackpool, took some actual refuse from a cleaning plant, and carbonized it, obtaining from 16 to 20 gaseous therms per ton out of that material. I took the trouble to calculate the balance on the same lines, in order to find out how much the therm would cost, if I took this fuel and gave it the benefit of assuming that it could be carbonized by itself. In point of fact, it could not be carbonized on its own, because it could not be heated with its own "coke," which, containing only 8 p.ct. of carbon, is practically fire-clay. I gave it the benefit of doing it on its own, and assumed that whatever carbon there was left in it was fit to be used in the producers for heating the retorts. While in the one case the cost per therm was 0·1d. for clean coal below the cost with ordinary coal—between 9d. and 10d. a ton of coal more profit than on the uncleaned coal—in the case of the refuse the therm would cost 2s. 6d., or about 2s. 3d. more than that from clean coal. This is impracticable, but it shows what you are doing every day with coal containing such refuse. You are carbonizing with the coal an appreciable amount of refuse, spending money on using the residue in the producers, on clinkering, and stand-by losses, and making eventually a less pure product for sale without getting any monetary return.

A still greater advantage can be derived in the case of water gas. Some of you may remember that, in the discussion on Mr. Cunnold's paper on the Nine Elms water gas plant, before the Southern Association of Gas Engineers and Managers (see "JOURNAL," Vol. 178, p. 120), I ventured to predict that, if we had truly clean coal, and made coke from it, our conception of the possibilities of gas makes from water gas generators would be entirely altered; and I adhere to-day to the views then expressed. The difficulty in water gas making to-day is the irregularity of quality due to the changes and the unevenness of the level of the fuel bed, or, rather, the clinker bed below. With mechanical extractors, matters are a little easier; it all goes down evenly, and the gas quality is more regular. In hand-worked water gas generators, however, it is very much more difficult, and the stand-by losses through clinkering operations, and re-heating after clinkering, all cost money, mean loss of efficiency, and hard work and little return for it. On the other hand, you have to bear in mind that coke from clean coal will have no more than from 3 to 4 or 4½ p.ct. of ash, and work will be easy.

Advisory Committee on New Courses of Lectures on Carbonization.

In connection with the new courses of lectures on carbonization and allied subjects which are being held at the Sir John Cass Technical Institute, we understand that an extension of the existing courses is contemplated, and that an Advisory Committee is being formed which will include several prominent men in the gas industry; we hope in a subsequent issue to be able to give the composition of this Committee.

The present course of lectures, which is being given by Mr. H. D. Greenwood, M.Sc., A.I.C., has been approved by the University of London for the M.Sc. Degree in Coal Carbonization, and we are pleased to learn that, of the students attending the course, quite a number are connected with the gas industry.

The second series of lectures, which commenced on Jan. 6, deals primarily with technical and economic considerations relating to different methods of coal carbonization and to water gas and producer gas practice.

A Carbonizer's Pilgrimage.

By H. J. TOOGOOD.

[Scottish Junior Gas Associations, Jan. 11.]

In 1904 there were no vertical retorts save in the abstract of idealism or in the daydreams of patent specifications. Inclined retorts were then considered the " last word " in retorting. There were few through horizontals, and even the few were stoked by shovel or scoop machines, and the coke was raked from both ends. Screened nut coal was not a commodity such as it is to-day. Gas was thought of in terms of candles and cubic feet, and 9500 c.ft. of gas per ton was considered excellent carbonizing. Electric power had not then been used in retort houses; in fact, there was considerable antagonism to its introduction, and in the early applications the current was always generated on the gas-works by gas engine. So strong was the objection in some quarters against electricity in the retort house (and a finely graduated variable speed being necessary for the projecting stoking machine), that a mechanical variable speed gear, consisting of a rope-drive down the retort house, expanding rope pulleys, and epicyclic gearing, was designed in 1905.

The success of inclined retorts at Edinburgh (the then Mecca of serious gas engineers), Leeds, Chesterfield, Shrewsbury, &c., wherein the force of gravity did the work of the stoker, naturally fired the imagination of many with the ideal of stoking through horizontals from one side, and thereby halving the retort house staff.

INTERMITTENT VERTICALS.

The practical success of harnessing the force of gravity to perform the stoking functions naturally quickened interest, so that the years 1904-06 were full of talk of the practicability of the dream of vertical retorting, and several units were said to be under, shall we say, more or less secret trial. The year 1906-07 saw our Technical Press aglow with the glamour of the success of the Continental intermittent verticals.

To appreciate the true perspective, it must be realized that at that period the Continent was already familiar with lower-grade gas, and incandescent lighting was there already established. In Britain we were still wedded to candle-power, and naked flat flames were largely in use. Hence it was but natural that success with vertical retorts should reward the pioneers in the use of the lower-grade gas.

However, British carbonizers felt it was up to them to meet this threatened foreign competition. Therefore, from several sources, movement began. Strange as it may now seem, it was felt that the primary factor to be considered was to get the gas away without abnormal pressure, and—to use a phrase much employed at that period—properly " cracked " to permanent gases by radiant heat.

Screened nut coal not being a commercial commodity, the belief at that period was that it was essential to screen the gas-works run-o-mine coal, and charge to the retorts simultaneously in two streams, so as to leave a column of cobs up which the gas could readily escape, and thus preserve the candle-power. This stoking machine theory of 1904 foreshadowed the idea of a dual feed to vertical retorts to be in error.

Practical experience so far having been with horizontals and inclines, with free-space over the charge (the days of heavy horizontal charges not yet having dawned), no surprise need be felt that the total loss of free-space could not be contemplated. Accordingly, serious thought was turned to free spaces for cracking selectively by radiant heat the outgoing vapours to permanent gases.

A measured or weighed charge of coal was the first considered solution, but here a factor new to carbonizing practice presented itself—the retort carbon or scurf would for the first time interfere to the extent of from 10 to 20 p.ct. with the coal capacity of each retort; and if a weighed charge was right for one retort, it would overfill to spoilation the next, so that a cap of green coal above the heat zone would result, which would disturb the distillation and degrade the gas. The problem looked formidable. However, a happy inspiration to build the charging hopper-door as a chute enabled each retort automatically to measure its own charge. During the period under review it was deemed tantamount to suicide to walk beneath the bench, as, should a catch slip, the incandescent coke would prove disastrous. However, practice has since proved that one may walk with impunity underneath an intermittent vertical retort bench. I only mention this to show how wide apart as the poles premise and practice can be.

Steam was admitted at the bottom mouthpieces for the last two hours of the 12-hour period, with the object of increasing the yield by the formation of water gas. The process, however, was limited, and in some cases was never practised.

CONTINUOUS VERTICAL RETORTS—1911.

The successful application of gravity to perform the stoking of intermittent verticals naturally resulted in renewed efforts to perfect the age-old ideal of continuous vertical retorts. To this end, descriptive matter amounting almost to a thesis on advanced thought on continuous carbonization of the period was set forth. This thesis formed the subject-matter of an application for a patent in July, 1911, which patent foreshadowed no fewer than five inventions, all of which were subsequently split from the mother application, contested, and upheld as valid and separate inventions—a point probably unique in patent law, and, I think, of general interest now.

The prevailing opinion of the period was that the coke extracting mechanism must be relieved of the weight of the superimposed charge, and claims existed at this period for inwardly projecting abutments to free the mechanism from this weight. These abutments, however, were abandoned. The idea was conceived that the maximum cross-section of the

H. J. TOOGOOD.

Mr. Toogood was educated at Merchant Venturers' College (now the University of Bristol), and became an Associated Member of the College in 1894. He joined the staff of Messrs. Robert Dempster & Sons, Ltd., of Elland, in 1904, and was elected to a seat on the Board of Directors in 1927.

charge should sit on a curved and slowly oscillating tray, thus imparting a two-fold motion to the coke, tending to prevent bridging and to render the discharge more regular. This tray did not lend itself to ready adaptation with the other details of the plant, so it was abandoned in favour of the inclined reciprocating tray. The motion of the tray is imparted (one 4½-in. stroke every 5 minutes) through silent friction ratchets and screw-cranks, capable of optimum adjustment for each retort.

At the outset the desirability of cooling the coke before discharge was recognized. That necessity is the mother of invention was never better exemplified than with continuous vertical retorts, for the great economy and improved working conditions brought about by dry-cooling the coke in a closed vessel owes its origin not to choice or design, but to the fact that the mechanism could not deal with incandescent coke. Since cooling became vital to success, the maximum available weight of cooling media—viz., secondary air, primary air, and water vapour for the producers—was circulated. It is interesting historically to note that in the pioneer plant at Hebden Bridge (1911) a unique arrangement was adopted, the plant being built sufficiently high to enable the abnormally cooled coke to be discharged direct from the retorts into consumers' carts,

whereby considerable labour was obviated and breeze formation prevented. This seemingly advantageous method has never yet been repeated.

Steam has, from the inception of verticals, always been admitted at the base of continuous vertical retorts, the original objects (1911) being:

(1) To maintain in the cooled coke receptacles an atmosphere of steam, whereby, on the opening of the lower mouthpiece lid, the stratum of invisible steam prevented the atmospheric air meeting the coal gas, and obviated "pops."
(2) The tar vapours floated above the steam, and so did not descend to condense on, and discolour, the cooled coke.
(3) Water gas formation.

In later years, especially the war years 1914-18, the great need for coal conservation caused official relaxation of the rigid standards of high-quality gas, which permissible lowering of the grade immediately resulted in increased steaming, and laid the foundation of the thermal standard of to-day.

So general is the steaming practice to-day that the younger generation of carbonizers will never fully realize what the beginning of vertical retorts was like when working with little steam and to a high standard gas, for "pops" and discoloured coke are to-day unknown. High steaming efficiencies were not obtained immediately; in fact, the big steaming results of to-day arrived as a two-stage process:

(1) A period of reduced coal throughput, to obtain the necessary incandescence of the coke.
(2) The use of higher heats and silica to maintain the coal throughput, and the desired temperature throughout the cross-section of the coke.

Principle of Heating Continuous Verticals.

The trend of thought on this important factor developed along these lines:

Theoretically considered in terms of the simple exchange of heat, contra-flow is best—*i.e.*, descending coal heated by ascending flames of combustion. Practically considered in terms of gas, the experience with intermittent verticals showed that the rich vapours must be distilled out towards the top of the retort, or degradation of gas and excessive scurf deposit would ensue. To state the case in a more practical way, the majority of the coal comprising the cross-section must be coked, thus giving the characteristics of coke to the charge while yet within reach of the control of stokers' bars from the top mouthpiece; otherwise continuity of descent could not be assured.

The principle adopted was to have the maximum heat applied (say) 5 ft. below the top mouthpiece; the products descending to heat the extreme bottom, and finally commingling to regenerate across the cold coal at the extreme top. In applying this principle there are many interesting subsidiary advantages—viz., the refractories most highly heated are:

(*a*) relieved of considerable weight;
(*b*) away from the corroding influences of incoming wet coal and outgoing green vapours;
(*c*) away from the erosion of the wet steam and water gas at the extreme bottom of the retort;
(*d*) within reasonable depth, to economize resetting;
(*e*) just below the chief wear of stokers' bars;
(*f*) free from horizontal floors, ledges, or panels, which might accumulate flue dust to flux and give trouble in the active zone of combustion.

The symmetry of the flues ensures that every horizontal cross-section of the charge is heated uniformly on each broadside.

Then came the grooved and tongued construction of the retorts and heating flues. The courses are 6 in. deep, and fit end to end alternately, so that few moulds are needed and a strong bond results. Each retort block spans between the flue walls, so that the unique result is attained that all vertical joints between the retort and the heating flues are cover-jointed by the walls. The bed joints are necessarily secured by the dead weight. Originally the retorts were square-cornered, but, to encourage the automatic peeling off of the scurf, the corners were "radiused" in the upper reaches of the retort where scurf is thickest. This rounding would be very expensive, seeing that so many specials would be entailed, owing to the retort tapering on both axes. The retort specials are 4½ in. thick at all vertical joints, and the bodies of the blocks are thinned to 3½ in. between the retort and the heating flues, to facilitate the economic transmission of heat.

Double-Taper of Retorts.

From the outset the permissible taper was realized to be but a compromise, because the advantage of an increased taper brought in its train the disadvantage of a thicker charge at the bottom of the retort, through which the heat must penetrate.

The charge at the top, being chiefly expanding coal, required the taper most. The charge at the bottom, being chiefly coke (the outer bulk of which is hardening and contracting), required the taper least. Hence the available taper was disposed variously; while the bottom is nearly parallel, the top is of rapid taper. The foregoing led up to the Dempster-Toogood system of continuous verticals; but naturally in the course of years there have been interesting developments which are outside the scope of this address.

When the pioneer plant was detailed in 1911, a regenerator was incorporated, as was at that date the universal custom with all settings; but, on putting this pioneer plant to work, though the secondary air gained in temperature, the waste gases did not drop in temperature. This unforeseen circumstance is explained as a phase of the reduction in ground space occupied, as a continuous vertical retort setting is so compact that the temperature from the combustion flues is conducted through the interior walls to such an extent that the waste gases are maintained hot by conduction. Consequently, since 1911 regenerators have been abandoned, and the secondary air is heated only by the outgoing coke and by flues in the outer wall of the setting.

Modernizing Horizontal Retorts.

The adoption of vertical retort carbonization grew apace, and actually it was shown by an eminent gas engineer in Scotland that the improvements in carbonization since the coming of the vertical retort had been such that twice the gas was being manufactured from the same tonnage of coal. The effect of this on the coke market was prodigious. South of Scotland, an eminent gas engineer gave it as his opinion that, consequent on greater coke sales, the prospects of cheaper gas were never more hopeful. Thus, coke being in greater relative demand, and the strong point of horizontal retorting being a greater coke-yield, it will easily be seen how the very success of vertical retorting has actually rehabilitated the horizontal retort. To-day, public opinion, fed on enthusiastic propaganda of many low-temperature plants designed to prevent smoke pollution of our atmosphere, is rapidly ripening for penalizing or prohibiting the burning of raw coal. As the days go by, it requires less and less imagination to visualize the universal use of smokeless solid fuel.

Tubular Regenerator.

There are many types of regenerator, which users compare with two common criticisms—air leaks and dusting-up. The two-ply large-area tubular regenerator was schemed chiefly to meet these universal criticisms. It offers two thicknesses of firebrick in the thin-divide between secondary air and waste heat, whereby it doubly safeguards against leakage from invisible fire-cracks, as, should a fire-crack develop in one tube, it is covered by the sound walls of the neighbouring tube. Also, it permits of ready heat transmission. The tubes being large, and pointed horizontally to the outer wall, permit of ready inspection, cleaning, and repairing on both sides of the thin divide, and, being built in staggered bonded formation, have great natural stability. All flues (waste heat and secondary air) can be inspected while at work. Thus the retort house staff get to know this particular regenerator as none other, automatically, as it were, which has a pronounced beneficial influence on the everyday good working of the plant.

Combustion Chamber Arches.

Combustion arches at this period were of various shapes, flat arch and horse-shoe predominating, which shapes, while being strong to resist the superimposed deadweight of brickwork, appeared to offer less resistance to a side-thrust. Bearing in mind that in a mass of incandescent brickwork, and the cooling of neighbouring setting during letting down, expansion strains may arise in any direction, it was felt that a completely circular arch should be the ideal. However, to give visibility of nostrils, to accommodate the active flame of combustion with least impingement, and to allow access for the retort setter in times of repair, the completely elliptical shape of arch was chosen; the lower keystone being common to both the combustion chamber arch and the producer arch. The usual solid centre wall is pierced with an elliptical arch, so that inspection and repairs may proceed from either side of the bench, which greatly facilitates everyday working in the retort house.

Producer.

The producer being the driving-force of carbonization, it should receive the most careful attention. Accordingly is seen the curtain wall giving constant depth of fuel—not a new idea, but one common to vertical retorting, and now applied to horizontal retorting. The benefits are obvious, as greater constancy of conditions is set up both within the setting being heated, and in the coke being gasified. Thus the requisite temperatures are attained with the minimum fuel consumption, with the coolest fire, and with least clinker formation.

Screen-Bar Grate.

To realize the effect of this grate on the coke, one must imagine the two-stage gasification; the primary-zone, where the air first meets the incandescent coke, being always the hotter, is the one where ash is fluxed into clinker. Consequently this primary zone requires to be disposed in the most accessible position.

The inclined screen-bar grate (there being practically no inclined brickwork) causes the whole of the coke constituting the primary zone to rest wholly on the accessible inclined screen,

down which it creeps as gasification proceeds, the ash gravitating through the screen.

Periodically this primary zone is pricked between the bars, but, there being no steps or ledges to arrest the coke or agglomerate the ash as in a step-grate, the fire remains more open and free-burning, so that gasification is more uniform over the whole grate area.

The curtain wall admits of subsidiary advantages—viz., twin producer gas flues, and a damper to control the producer gas to each half of the setting. Gasification being now fully controlled from the back of the fire obviates the need for any doors to the ashpit; hence economy ensues, and greater regularity is attained, as there is now no open-door period.

All need of primary air control being obviated, there are no primary air slides to adjust, and there is consequent simplification in the control of heats.

The furnace charging door now gently slides on the extended frame, so that, as it never leaves the hot sealing faces, the tendency to warp is mitigated, and the insulation is better retained. No lid lifter is required, and a single hand-pull of 30 lbs. easily slides a door weighing 200 lbs.

Having in recent years built several miles of silica built-up retorts, many of which are approaching the allotted span of life—2000 working days—and there being no resetting orders yet foreshadowed, it can with confidence be said that the use of silica retorts is fully established.

Heat Losses from Bench Brickwork.

Though it is generally believed that the hotter the exposed brickwork the greater the heat loss, and the more the need for insulation, the exact opposite is often the case. This paradox is not easily explained. Imagine that the surrounding atmosphere did not absorb heat from the exposed brickwork. Then it is easy to realize that our bench brickwork would be red-hot all over the outside surfaces. Hence it will be clear that, in actual practice, where the atmosphere absorbs least heat from the bench brickwork, that exposed brickwork will be the hottest, and will require the least insulation. Therefore the horizontal bench top, having relatively stagnant atmosphere, may approach the temperature of red heat and not be overwasteful of fuel. It will be hottest, and require the least insulation; whereas the bench-fronts, being vertical, induce a rush of ascending atmospheric currents in close proximity to the brickwork, which absorbs considerable heat from the bench fronts, so that the exposed brickwork will be the coolest, and will require the greatest insulation.

This feature was realized in 1909, and, in order to stagnate the atmosphere adjacent to the bench fronts, the bracings were made into 3 ft. walking way, abutting on the brickwork, thereby diverting the ascending air streams to move some distance from the bench fronts. I do not in any way decry the use of insulation, but I want that insulation placed where most serviceable to fuel conservation and comfort of the men.

Radiation losses are reduced in three ways:

(1) More efficient construction. For a given carbonizing capacity, the over-all size of the setting is reduced to 9 ft. 9 in. centres of buckstays.
(2) Less ironwork used in bench mountings to conduct the heat away (20 ascension pipes replaced by 2 descension pipes).
(3) Double bench fronts, bonded through with strong firebrick headers, yet (paradoxically) insulated internally over all the area with porous insulating bricks 2½ in. thick.

The main arch is conspicuous by its absence, and the economies of the flat bench cover are fairly obvious. What, however, is not clear, is the long and interesting trail of observations and experiences which led up to this simple departure from the accepted practice of a hundred years.

Laboratory experience has been freely published on the expansion of silica material, and I fear has generally been confounded with the expansion of silica construction, about which very little has been recorded. In the laboratory, a silica sample piece is heated, and its expansion curves are plotted. Silica has two critical periods of expansion, half-red heat (250° C.) and full-red heat (500° C.); these being dangerous peaks of almost sudden expansion.

In retort settings there is something totally different—viz., a silica interior within a firebrick shell. Herein lies much misunderstanding and trouble. While thinking in terms of laboratory statistics, practicians have gradually gleaned that their difficulty is something new, which, for want of a better description, I call the relative expansion between the firebrick and silica masses. Gradually designers have introduced slip joints (say, paper) between the silica masses and firebrick masses, not to accommodate expansion only, but, by allowing the silica mass to creep at 250° C. (without damage to flues) over the yet stationary firebrick masses (and similarly the firebrick masses over the silica masses at a later stage), to bring the correct solution to silica construction.

A silica setting within a firebrick main arch offers an interesting but insoluble problem. Assume that the correct expansion clearance has been left under the main arch for the upward expansion of silica. This is absorbed by the early expansion of the silica interior mass. At some later period the firebrick pier walls expand, and lift the main arch, thus restoring the above clearance. Into this clearance the top retorts tend to be distorted under the action of the pusher stoking machine on a buckled charge. *Vice versa*, had the clearance been less, then the top and green retorts would tend to become distorted by crushing on the first raising of the heats. Consequently, the only true solution is to abandon the main arch and to substitute a flat deadweight bench cover, when at once the fitness of things becomes apparent—viz.:

(1) Differential expansion of silica and firebrick is perfectly accommodated.
(2) Thrust of erstwhile main arches non-existent.
(3) Each setting rendered completely independent; hence no cumulative expansion along the length of the bench.
(4) Economy introduced of no wood centres, and no cutting of brick to curvature of arch; retort setters work with less stooping, and simple props suffice, there being no thrust from arches.
(5) Less mass brickwork to heat; hence economy in first cost and efficiency of fuel, and less heat radiated to hydraulics.
(6) Last, but not least, when resetting you do not repeat the age-old error of putting new wine into old bottles, but relay the cover.

Descension (Scrubber) Offtake Pipes.

In horizontal practice a steady effort has been maintained to improve the gas offtake arrangements, to alleviate the labour of pipe augering, among which might be mentioned anti-dips, Darwen scrubber pipes, and tar towers. Nevertheless, stopped pipes continue to be the bar to progress, because any serious attempt to increase efficiency by adopting silica retorts and increasing the carbonizing temperature was immediately countered by an increased number of stopped pipes. Realizing that all ascension pipes are (considered alone) in reality chimney-vents to the retorts, and that these chimneys, being hottest at the end of the charge period, when the yield is at the minimum and the gas lean, and coolest at the beginning of the charge-period, when the gas yield is at the maximum and the gas is heavily laden, it will be seen that the chimney capacity fluctuates inversely as the gas requirements. Hence, in this respect, the principle of ascension was deemed theoretically wrong, and, conversely, the principle of descension right, as it acts directly with, and assists, the gas requirements thermally.

The descension (scrubber) offtake pipe being common to 5 retorts, and the 5 retorts being at all times in widely different stages of distillation, it follows by the law of averages that the interior temperature is more constant, and that the ideal level-gauge conditions are much more nearly maintained with less degradation of gas and with the maintenance of tighter retorts, whence the gas-yield is enhanced both qualitatively and quantitatively. Incidentally, the bench-top is rendered perfectly free from all mountings. The seal pots and retort house governors or controls are grouped where much more readily observed at ground level—a feature of no mean importance.

The liquor spray for scrubbing the gas is cooled and recirculated at approximately 500 gallons per ton of coal carbonized, and between the narrow limits of 130° to 100° Fahr., so that practically no free ammonia is present either to cause smell, or, by absorbing acids, to complicate the effluents problem.

Retort House Governor Control.

Much improvement has in recent times been achieved in this respect; external power or relay control having in some cases been substituted for the usual retort house governor. Believing, however, that what is wanted is not an improved form of retort house governor, but rather a series of governors, one for each bed of retorts, and knowing that consideration of first cost prohibited this, I was privileged to submit a reasoned article to the "Gas Journal" in June, 1929 (June 12, p. 811), suggesting a cheap form of float-control of a liquor seal valve, the relay being derived from the usual (but augmented) liquor dribble. I have good reasons to believe this theory will shortly be put to practical proof, and, if successful, we shall be one step nearer the carbonizer's ideal—level-gauge at all times for every retort.

Coke.

The importance of coke cannot be over-estimated. As yet domestic heating by solid fuel is a monopoly of coal, and the rivalry to secure the domestic market grows apace, so much so that I consider a reference to the Coke Competition Number of the "Gas Journal" (Nov. 9, 1925) will not be out of place. The aim of the Competition was to focus attention on the merits of coke, and in this it was extremely successful. It was my privilege to secure a coveted prize in each of the three sections—viz.: (1) Coke Production, (2) Coke Preparation, and (3) Coke Sales. The first was as "High-Low-Game," championing the idea that gas-works should produce low-tempera-

ture fuel as a side issue, and in present-day retorts, in order to discourage public funds setting up a separate industry to compete with coke.

The second was as "One-Step," showing the advantage of the simpler handling of coke from retorts to screens by one machine and in one step.

The third was as "Open-Sesame," endeavouring to show, while tens of thousands of domestic open grates were continually being supplied, designed to burn coal, but which would not properly burn coke, the advisability of reversing the order and putting forward open domestic grates designed to burn coke which would obviously also burn coal.

I submit that even to-day this series of Competition Papers is full of live interest to any carbonizer.

Coal in the domestic grate is comparable with a process of "distillation," whereas coke in a domestic grate is a process of "gasification." A full recognition of this fundamental difference will bring out the great need for screening coke into as many grades as is possible. A given weight of coke, containing cobs of equal sizes and similar shapes, will so fill a given cubic space (a grate) as to offer that highly desirable combination—the maximum air space within the fire with the maximum surface contact. Hence the air becomes hotter and the incandescent surface greater, so that the best gasification conditions are established. Therefore, unequal sized coke in any one fire should be avoided, which, in practice, simply means screening coke into numerous grades. The more the grades, the greater the satisfaction of the service rendered to the greatest number. Naturally, the larger the grate, the larger the cobs of coke may be; but this aspect is but supplementary to the real factor—"Equality of cobs on any given fire."

Discussion.

Mr. R. D. KEILLOR, President of the Western District, suggested that Mr. Toogood's statement that the upright walls dissipated more heat to the atmosphere than did horizontal surfaces showed there must be a greater loss in vertical retorts than in horizontals.

Mr. TOOGOOD said that vertical walls radiated more heat to the atmosphere, but there were compensating advantages with vertical retorts which outweighed this effect.

Mr. A. DOW (Galashiels) said he had gained a great amount of information from Mr. Toogood's address. At present they had two Dempster-Toogood plants in Scotland—at Hawick and Galashiels. At Galashiels the original horizontals were built by Messrs. Robert Dempster & Sons, Ltd., of Elland; and he had no regrets when they changed over to the Toogood patent. They enjoyed perfect working, and it was two months since he had been on the top of the bench, as the charge was well held with practically no pressure on the tray. He had carbonized sawdust mixed with coal, and he thought this was very remarkable for a vertical retort. Speaking of insulation at Galashiels, they had the inside of the walls secured to the brickwork on the bench by firebrick, with a firebrick header protruding through the course of the insulation brick. Visitors, after inspecting the heat (1400° C.), were asked to place their hands on this header, and were scorched with this firebrick, while the hand could be comfortably retained on the insulation. By test, his fuel consumption was found to work out at 15 lbs. of coke per 100 lbs. of coal carbonized. He would bear out what had been said in regard to the screen-bar grate. His bar grate had been working since September, and they had not yet seen the back wall or felt any clinker formation. In his step grate in the neighbouring bed they had to clean the back wall of clinker every fourteen days. He was confident of running the 52 weeks with the bar grate without cleaning. He considered this a great step in furnace construction. From his experience, tests on silica in the laboratory could not be applied to actual practice.

Mr. DAVID FULTON (President of the North British Association of Gas Managers) thanked Mr. Scobie (President of the Eastern District) for his welcome. He was envious of Mr. Toogood's memory and learning, and his address had been most informative and entertaining. Most of them thought that the profit or loss on gas was made in the retort house; but he doubted whether this was the case to-day. He thought the stage of refinement had been reached in this direction. The bar grate was an excellent idea for the vertical retort setting. He agreed with Mr. Dow that the flat grate with horizontal bars gave clinker trouble when the fires were burned down. Broad steps on the step grate might be effective, but a certain loss in the depth of the bed under the curtain arch was apparent. The bar grate was not exactly unique, and he considered the inclined bar producer very good, though it did not prevent waste of coke in the ashpan or the formation of clinker. The influence of vertical retorts made itself felt in regard to saleable coke, and it should be their endeavour to keep down this production, as the export of coke at comparative low prices was a vital fact to consider when the balance-sheet was examined.

Mr. TOOGOOD, replying, assured them he had enjoyed every minute. His acknowledgment was due to his firm, for the loan of the models; and also he would acknowledge the past services of all who had worked with him in willing team service, embracing his right-hand man, Mr. W. Hanson, and his latest recruit, Mr. M. Haigh.

Combustion, Wind, and Flue Equipment.

By C. A. MASTERMAN, B.A., A.I C., of the Gas Light and Coke Company

[From a Paper before the Institution of Heating and Ventilating Engineers, Jan. 8.]

SECTION I.

COMBUSTION.

The combustion of any fuel consists of a complex series of chemical reactions, with each one of which is associated a certain amount of heat.

We are concerned at the moment only with the final products of combustion, and these are shown in Table I. for samples of various fuels, assuming that only the minimum theoretical quantity of air is used.

TABLE I.—*Undiluted Products of Combustion in Lbs. per 10,000 B.Th.U. (Air 70 P Ct. Saturated at 60° Fahr)*

Fuel.	Calorific Value B.Th.U.	Carbon Dioxide.	Water Vapour	Residual Nitrogen.	Weight of Products in Lbs.	Vol. of Products in C.Ft. at 500° Fahr.	Weight of Products per C.Ft. in Lbs. at 500° Fahr.
	Per C.Ft.						
Coal gas (Gas Light and Coke Co.)—							
Gross	500	1·13	1·02	4·98	7·13	182	0·0392
Net	451	1·24	1·15	5·58	7·97	203	
	Per Lb.						
Bituminous coal—							
Gross	15,090	1·96	0·38	5·46	7·80	183	0·0427†
Net	14,530	2·03	0·40	5·67	8·10	190	
Gas coke—							
Gross	12,990	2·50	0·07	5·96	8·53	188	0·0453†
Net	12,970	2·50	0·07	5·97	8·54	188	
Mexican fuel oil—							
Gross	19,000	1·64	0·58	5·43	7·65	185	0·0413‡
Net	17,910	1·74	0·61	5·76	8·11	191	

† The presence of smoke will increase this value.

‡ Approximately the same as dry air at the same temperature.

AIR REQUIREMENTS.

These figures pre-suppose an ideal state of affairs in which exactly the correct proportion of air for complete combustion is supplied and used. This, at least with solid fuel boilers, is rarely achieved even with the most carefully controlled stoking, and excess of air is aimed at since the heat thereby wasted is of smaller dimension than that lost by incomplete combustion. Lack of air will normally result in unconsumed carbon monoxide passing up the chimney flue, a heat loss of nearly 320 B.Th.U. per c.ft. of this gas. A corresponding excess of air would only carry away about a tenth of this as sensible heat. Air excess rather than deficit is therefore preferable with solid fuel boilers, some portion being admitted above the fuel bed in order to meet and combine with the gases formed therein. Even so some carbon monoxide is always present in the flue gases owing to the difficulty of introducing this secondary air evenly throughout the grate. Chilling of the flame will also contribute to this carbon monoxide formation.

The presence of carbon monoxide in the flue gases of high-efficiency boilers is stressed since the necessity for flue equipment at all may be said largely to depend upon this fact. Not only has an adequate draught to be provided to draw in air through and over the fuel bed, but, owing to the poisonous character of carbon monoxide itself (as little as 0·02 p.ct. in inspired air has measurable ill-effect), the products of combustion must be removed from the boiler house.

Somewhat different considerations apply to coal gas as a fuel—a development of which will be mentioned later. The ease with which complete combustion can be obtained with this fuel even with only small excess air, together with the low sulphur content in the coal gas, results in products of combustion of innocuous character. Carbon monoxide can, of course, be produced if the boiler is ill-designed or if down-draught causes products of combustion to pass back on to the burner, but normal combustion products from coal gas consist of carbon dioxide, water vapour, and residual nitrogen, with traces only of sulphur dioxide.

Forced draught is, of course, necessary with some boilers,

but the more usual natural draught alone is dealt with in this paper. This draught is obtained by the use of a vertical chimney, and is purely a temperature effect, in no sense being natural to the chimney as such.

SECTION 2.

DIMENSIONS OF FLUE PULL.

If a vertical flue or chimney contains a gas lighter than air, the gas will escape upwards owing to lack of gravimetric balance at the base of the flue. If such escape is prevented (say) by capping the top, a static pressure will be produced equal to the difference in weight of this gas and the weight of a corresponding column of air at the external temperature t_a° Fahr. Table I. shows the normal density of the flue products to be not very different from that of air, but the fact that they are hot, and therefore expanded, obviously results in a reduced effective density. The dimensions of the static pressure will therefore be given by the expression

$$\text{Pressure } P = HG_a - HG_2.$$

Taking weight of 1 c.ft. of air at 60° Fahr. = 0·076 lb.

$$P = \frac{H \times 0{\cdot}076 \times 521}{t_a + 461} - \frac{H \times G_1 \times 961}{t_a + t + 461}$$

where

G_a = Weight of 1 c.ft. of air in lbs. at t_a° Fahr.
G_1 = Weight of 1 c.ft. of flue gases in lbs. at 500° Fahr.
G_2 = Weight of 1 c.ft. of flue gases in lbs. at $t_a + t$° Fahr.
H = Height of flue in feet.
P = Pressure difference in lbs. per sq. ft.

Fig. 1 shows the static pull in 10 ft. of flue at atmospheric temperature 60° Fahr., using the values for G_1, shown in Table I. for undiluted products. Increased dilution will clearly not affect the results from oil—the products from which have approximately the density of air. Products from other fuels will, with increasing dilution, approach this same value.

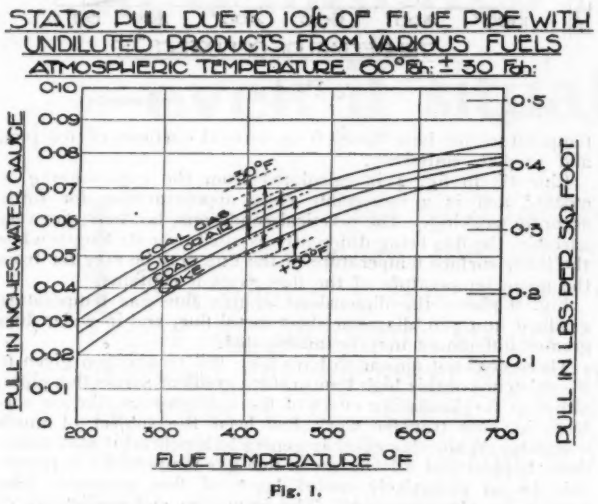


Fig. 1.

Static pull will increase with temperature towards a limit, which is the weight of the external column of air *in vacuo*, and this is only reached when expansion is infinite (0·76 lb. per sq. ft. at 60° Fahr. in fig. 1).

The effect of 30° Fahr. fall and rise in external air temperature is also indicated, and is seen to be large (± 10 p.ct.). The external temperature is assumed to be 60° Fahr. in subsequent calculations, since this is, from the point of view of pull, the most pessimistic condition, heating boilers normally being out of use during the summer.

SECTION 3.

MOVEMENT AND EXPANSION OF PRODUCTS.

The static pull in a chimney does not represent a true condition, since the flue gases are in fact allowed more or less freely to pass up the chimney. The pull or pressure difference then accomplishes two results.

(1) Causes acceleration in flue gases.
(2) Maintains velocity of flue gases against various resistances.

This double function of the chimney pull is not always recognized, and it definitely complicates any expression by which might be expressed the resultant velocity of products.

COEFFICIENT OF APPARENT EXPANSION.

The balance of heat passing from the boiler into the flue is responsible for a definite expansion in the flue gases, which in turn causes the upward movement in the flue.

An error of less than 2 p.ct. is involved if it is assumed that the specific heat of air remains constant over flue temperature range (100° to 800° Fahr.) at 0·24 B.Th.U. per lb. per ° Fahr. Expansion of any volume of air on application of heat may be shown to amount to 0·1052 c.ft. per B.Th.U. input.

The combustion of fuel is accompanied not only by heat but also by the production of carbon dioxide, water vapour, and residual nitrogen. These gases modify the specific heat of the resulting mixture, and they also affect the density of the flue gas as compared to air at the same temperature. These effects will be *pro rata* not to the final heat in the flue gases but to the initial heat of combustion of the fuel burnt. The ratio of initial heat to heat in the flue will depend upon boiler efficiency and other factors (Table II. later).

The coefficient of apparent expansion *e* must take into account these modifications, since its value represents the volume difference in cubic feet per B.Th.U. (sensible heat) content between equal weights of cold air and hot flue gases.

The values for this apparent expansion may be shown to approximate closely to a mean value of 0·1 c.ft. per B.Th.U. input to flue, a value which will remain independent of dilution.

SECTION 4.

VELOCITY OF PRODUCTS IN FLUE.

The flue or chimney (fig. 2) of height H ft. may be considered in operation as containing two volumes A(H − H_E)

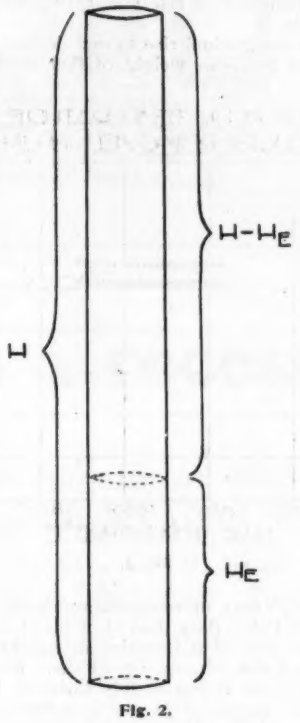


Fig. 2.

corresponding to air at temperature t_a° Fahr. and AH corresponding to the apparent expansion. [A = cross-sectional area in sq. ft.]

$$\text{Height of apparent expansion } H_E = \frac{\text{Vol. apparent expansion per sec.} \times \text{flue height}}{\text{Cross sectional area} \times \text{velocity of products}}$$

The static pull is clearly equal to the pressure *in vacuo* of a column of air H_E ft. high.

$$= 0{\cdot}076\ H_E \text{ at } 60° \text{ Fahr.}$$

The pressure head in feet or the height of a column of flue gases producing this pressure *in vacuo*.

$$= H_E \times \frac{H}{H - H_E}$$

Part only of this will be available for inducing movement of flue gases, the remainder being used in overcoming the resistance of the flue, R. [lbs. per sq. ft.].

$$\text{Pressure head inducing movement} = \frac{H}{H - H_E}\left(H_E - \frac{R}{0{\cdot}076}\right)$$

Hence, assuming coefficient of discharge = 1,

$$\text{Velocity of products} = \sqrt{\frac{H}{H - H_E}\left(H_E - \frac{R}{0{\cdot}076}\right)2g}$$

[g = gravimetric constant.]

From this further equations are derived for use in the subsequent development of general expressions relating critical dimensions of chimney with duty required.

SECTION 5.

PERFORMANCE OF FLUE EQUIPMENT.

There is necessarily a relationship between the heat and combustion products produced from any fuel. Table I. shows the minimum weight of undiluted products requiring removal for

various fuels per 10,000 B.Th.U. The advantage of allowing a certain excess air has been mentioned and it is proposed to allow for removal of 10 lbs. of products per 10,000 gross B.Th.U. in the fuel consumed. With this allowance the volume analysis in respect of CO_2 shows a slight margin of excess air over best working conditions.

Section 6.

HEAT AVAILABLE IN FLUE.

The value of the effective heat in the flue or chimney will clearly be a function of the sensible heat entering the flue. Any precise general expression for the latter is impossible since its value depends upon the efficiency and arrangement of the boiler.

This uncertainty is less important than might at first sight appear since increase in flue temperature does not indefinitely increase the weight of products removed. The existence of a maximum may easily be established.

This point is reached when the temperature has caused expansion to double the original volume, and above this point the continued expansion gradually reduces the total weight of products passed, though volume velocity continues to increase.

If the temperature of the air is 60° Fahr., this point is reached when temperature rise t = 521° Fahr., or a temperature of 581° Fahr.

Fig. 3 shows the gradual rise to and decline from this maximum in general terms of weight of flue products passed (for

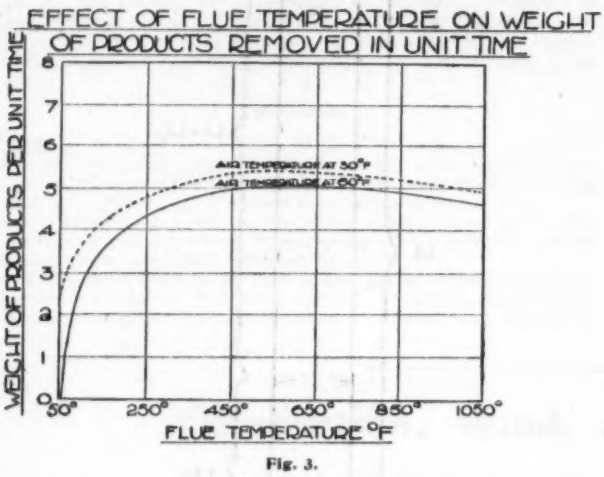


Fig. 3.

air). The small effect of temperature changes between 400° Fahr. and 900° Fahr. (less than ± 1 p.ct.) is of considerable importance. 80 p.ct. of the maximum weight of air is passed at a temperature rise of only 130° Fahr. Provided the mean effective temperature is not unduly lowered, the heat content of the flue gases clearly plays a very subordinate quantitative part in the removal of products.

The best and worst normal working figures for boilers on different fuels are suggested in Table II. in terms of M (gross calorific value of fuel consumed per second in B.Th.U.), and from these are derived mean values for the heat input, Mx, into the flues. Full consumption loads are assumed since flues large enough for full load will be adequate for reduced consumption.

Table II.

Fuel.	To Water f/3600.	Latent Heat.	Heat Losses (Boiler, Ash, &c.)	Sensible Heat to Flue = Mx.	Mean Mx.	M.
Coal gas .	{0·80 / 0·70}	0·10 / 0·10	0·04 / 0·08	0·06 / 0·12	0·09 = $3f \times 10^{-5}$	f/2700
Coal. . .	{0·70 / 0·55}	0·04 / 0·04	0·10 / 0·15	0·16 / 0·26	0·21 = $9f \times 10^{-5}$	f/2225
Coke . .	{0·70 / 0·55}	.. / ..	0·10 / 0·15	0·20 / 0·30	0·25 = $11f \times 10^{-5}$	f/2225
Oil . .	{0·75 / 0·65}	0·06 / 0·06	0·05 / 0·11	0·14 / 0·18	0·16 = $6f \times 10^{-5}$	f/2520

[f = Boiler rating = B.Th.U. transferred to the water per hour.]

Maximum and Normal Removal of Products.

A sensible heat content in the flue gases representing under 15 p.ct. of the gross calorific value of the fuel is sufficient to maintain the effective flue temperature in the maximum range and so to remove within 2 p.ct. of the maximum weight of products of which the flue is capable. Increase in density of flue products due to the presence of carbon dioxide accounts for a slight raising of this range compared to fig. 3. (In the case of coal gas a lowering occurs.) Similarly about 5 p.ct. of the total heat will cause removal of 80 p.ct. of the maximum. Inspection of Table II. shows that in the case of solid fuel the heat input to base of flue will rarely be below 20 p.ct. In these conditions the development of a general expression may be much simplified.

In practice the effective heat may be considerably less than the heat input to the flue owing to heat losses from the flue walls, so that the proposed simplification can only be used where either there is considerable margin of heat as with solid fuel or the heat losses from flue are known to be small.

Heat Losses from Flue.

Ignoring heat losses from horizontal runs of flue,

$$\text{Effective heat throughout} = \text{Heat input} - \frac{\text{Flue losses}}{2}$$

Fig. 4 shows calculated values* for q (mean heat loss per sq. ft. of flue surface per hour in B.Th.U.) at 60° Fahr. air

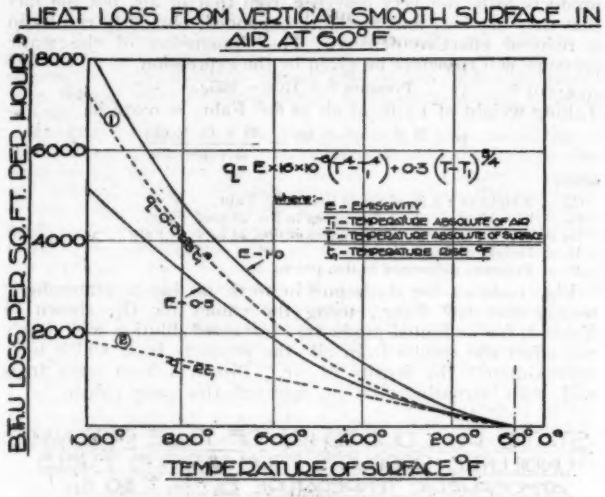


Fig. 4.

temperature for heat losses from vertical surfaces of 100 p.ct. and 50 p.ct. emissivity.

Line (1) in fig. 4 is calculated from the expression $q = 0{\cdot}008t_1^2$ and is a reasonably close approximation for fairly accurate working. The practical conditions, however, are very variable, the flue being differently exposed over its length while the inner surface temperature of the flue may be very far from the mean temperature of the flue gases it contains.

Fig. 8 shows the dimensions of this flue gas temperature gradient in a 4-in. diameter sheet metal flue, and in wider flues greater differences may be anticipated.

There does not appear to have been full recognition given to the existence of this high temperature gradient across flue pipes, although the insulating effect of the cool gaseous film on surfaces in heat transfer work has been the subject of much research. While this effect is generally beneficial it may sometimes happen that a lower mean flue gas temperature is preferable to an excessively cooled layer of flue products. (See Section 10, Condensation.) The formation and persistence of this cool shell and hot core certainly renders the popular mechanical conception of turbulent flow somewhat inappropriate, and I hope later to have the opportunity of following up the effect in closer experimental detail. The Dvorzak Boys point light method used by Prof. M. Kirpitcheff† for exploring air movement outside hot pipes appears a promising method of approach.

The actual heat loss from flue pipes will therefore be variable according to the straightness or otherwise of the pipe run and will in any case be less, often much less, than that calculated on the assumption of flue wall temperature being equal to mean flue gas temperature. Since this latter must be the practical datum, a rougher approximation for the relation between heat loss and temperature seems legitimate and $q = 2t_1$ corresponding to line (2), fig. 4, is proposed. The lower values so obtained may roughly compensate the otherwise high values given by assuming mean inner flue wall temperature is the same as mean flue gas temperature (t° Fahr. rise). In the more critical temperature zone, from the point of view of movement of flue gases, the expression $q = 2t_1$ corresponds fairly closely to the curves shown.

Hence fairly simple expressions are derived relating effective flue heat with heat input in terms of conductivity of flue wall, surface area, &c.

(To be continued.)

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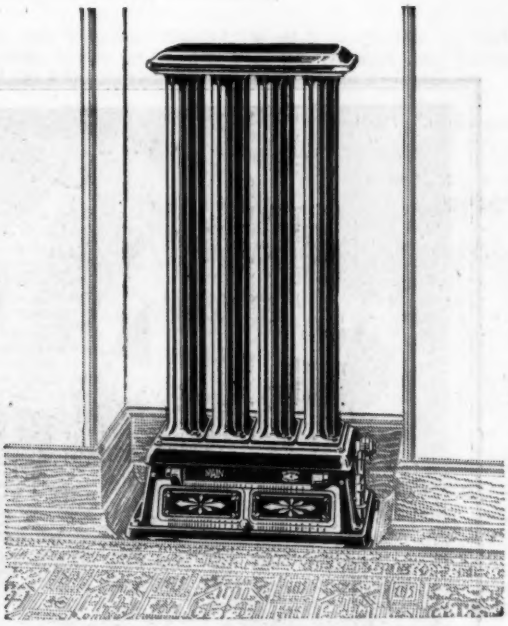
* $q = e \times 16 \times 10^{-8} (T_a^4 - T_1^4) + 0{\cdot}3 (T_a - T_1)$ ‡
where T_a and T_1 are absolute temperatures.
e = expansion coefficient* = apparent expansion per B.Th.U. in c.ft.
Dr. Margaret Fishenden, "House Heating."
Griffiths and Davis. Special Report No. 9, Food Investigation Board.

† M. Kirpitcheff. Part III., Paper K 16. Trans. Fuel Conference, London, 1928.

A new design of Radiator that can be dismantled for cleaning in 5 minutes —even if situated in a recess



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Liquid Purification by Soda Ash Solution.

By W. J. G. DAVEY, B.Sc., Chief Chemist, Gas-Works, Birkenhead.

The subject of liquid purification is once more to the fore; and though the discussion thereon is mainly concerned with the question of ammonia recovery, perhaps a little time and space can be devoted with advantage to a process dealing with sulphur removal, without reference to ammonia—a process which was once widely discussed, but is now only mentioned to demonstrate its failure to meet British conditions. I refer to the Seaboard process of sulphuretted hydrogen and cyanogen removal by washing the foul gas with a weak solution of soda ash.

Briefly stated, this process consists in passing the crude gas up a tower down which a 3 p.ct. solution of soda ash is being sprayed, and actifying the resultant liquor by passing down a second tower against a blast of air. The foul gases from the actifier are rendered innocuous by passing through an oxide purifier, or burning beneath boilers. The possibilities of this process can only be appreciated, and improvements which will bring it into line with British requirements effected, when the reactions involved are understood. According to the American inventors, the rationale of the process is as follows:

The absorption stage of the process is characterized by three reactions between the acidic constituents of the gas and the sodium carbonate in solution.

(1) $H_2S + Na_2CO_3 = NaHS + NaHCO_3$
(2) $CO_2 + H_2O + Na_2CO_3 = 2NaHCO_3$
(3) $HCN + Na_2CO_3 = NaCN + NaHCO_3$.

These are reversible reactions, governed by the law of chemical mass reaction, and under proper conditions may be caused to proceed from left to right. Such conditions produce the actification stage of the process as follows:

(4) $NaHCO_3 + NaHS = Na_2CO_3 + H_2S$
(5) $2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$
(6) $NaHCO_3 + NaCN = Na_2CO_3 + HCN$.

Consideration of the foregoing equations will show that the essential requirement of actification is the decomposition of the sodium hydrosulphide (NaHS) and the sodium cyanide (NaCN) formed in the absorption stage. The sodium bicarbonate ($NaHCO_3$) also undergoes direct decomposition; but since we are not especially concerned with the removal of carbon dioxide from the gas, the bicarbonate is of principal importance in its reactions with the sodium hydrosulphide and cyanide, and its complete decomposition in the actification stage is neither necessary nor desirable. The decomposition of the sodium hydrosulphide and cyanide, according to reactions (4) and (6) inclusive, is favoured by the following conditions:

(1) Presence of an excess of sodium bicarbonate.
(2) Rapid dilution or rapid removal of the gaseous products of reaction, H_2S and HCN.
(3) Presence of an excess of CO_2 in contact with the solution in the actifier.

In addition to the primary reactions, minor secondary reactions occur—namely, the formation of sodium thiosulphate and sodium thiocyanate. These are inactive salts and are very soluble in water. The decrease in strength of solution due to the formation of these salts is made up by periodic additions of soda ash. We feel fully justified in allowing these inactive substances to accumulate till their rate of formation is balanced by the mechanical losses of solution. (Sperr, "Gas World," April 22, 1922, p. 335.)

The process was adopted at Southport in 1924 to supplement the oxide purification plant, and was described by Mr. T. R. Cook in a paper before the Manchester and District Junior Gas Association on Nov. 11, 1925. ["JOURNAL" for Nov. 18, 1925, p. 432.] This report deals with investigations carried out during the preparation, and subsequent to the reading, of that paper, in collaboration with Mr. Cook, and in accordance with the instructions of Mr. J. Bond, O.B.E., Engineer and Manager of the Southport Corporation Gas Department; and it is by the courtesy of these gentlemen that I am permitted to publish the results.

In the first place it was difficult to accept the equations published in Sperr's paper. Indeed, it would appear that the salt of a stronger acid, carbonic acid, would have very little effect on the absorption of a weaker acid, sulphuretted hydrogen, and still less on the absorption of the much weaker acid, hydrocyanic acid. The Koppers Company, however, with 3 p.ct. soda ash solution, claim to extract 91 p.ct. of H_2S from gas containing 270 grains of H_2S per 100 c.ft., and also to extract practically all the hydrocyanic acid; while at Southport about 47 p.ct. of H_2S and 62 p.ct. of HCN was being removed from gas containing 560 grains of H_2S and 32 grains of HCN per 100 c.ft. Thus it was decided that some reaction must be effected by reason of the concentration of the acid impurities in the foul gas.

A laboratory test showed that, when excess sulphuretted hydrogen is passed through a 3 p.ct. soda ash solution, the resultant solution contains 0·96 p.ct. of H_2S, which is in accordance with the equation $Na_2CO_3 + H_2S = NaHS + NaHCO_3$. Analysis of the foul and actified liquors were then carried out, and the following results obtained:

TABLE I.—*Analyses of Samples of Foul and Actified Liquor from the Liquid Purification Plant.*

	Foul.		Actified.	
	P.Ct.	As Sulphur.	P.Ct.	As Sulphur.
Ammonia (NH_3)	0·281	..	0·255	..
Carbonate (H_2CO_3)	2·730	..	2·177	..
Total Sulphur (S_2)	3·038	3·038	2·996	2·996
Sulphate (H_2SO_4)	1·343	0·452	1·399	0·457
Sulphite (H_2SO_3)	0·051	0·020	0·282	0·110
Thiosulphate ($H_2S_2O_3$)	0·207	0·116	0·190	0·107
Thiocyanate (HCNS)	4·038	2·190	4·161	2·257
Cyanide (HCN)	0·250	..	Trace	..
Ferrocyanide ($H_4Fe(CN)_6$)	0·027	..	0·022	..
Sulphide (H_2S)	0·242	0·228	0·116	0·109

From these results it was anticipated that the following reactions might occur:

PURIFICATION OF GAS AND FOULING OF LIQUOR.

Primary reactions resulting in absorption of H_2S, HCN, and CO_2:

$Na_2CO_3 + H_2S = NaHS + NaHCO_3$
$Na_2CO_3 + HCN = NaCN + NaHCO_3$
$Na_2CO_3 + CO_2 + H_2O = 2NaHCO_3$.

Secondary reactions resulting in the absorption of carbon bisulphide with formation of sodium thiocarbonate. ("An average of some 30 tests showed that the sulphur content of the gas has been reduced from 33 to 11 grains per 100 c.ft."—Mr. Cook before the Manchester Juniors, *loc. cit.*)

$2NaHS + CS_2 = Na_2CS_3 + H_2S$.

Tertiary reactions.—The thiocarbonate would probably hydrolyze:

$Na_2CS_3 + 3H_2O = Na_2CO_3 + 3H_2S$.

Some sulphuretted hydrogen, hydrocyanic acid, carbonic acid, and carbon bisulphide would thus be extracted from the foul gas, and an equilibrium solution of carbonate, cyanide, hydrosulphide, and bicarbonate of soda would result.

REVIVIFICATION REACTIONS.

Under the influence of the air blast the sodium hydrosulphide would partially oxidize, first to sodium polysulphide:

$2NaHS + O = Na_2S_2 + H_2O$.

Further oxidation of the polysulphide would yield thiosulphate, sulphite, and finally sulphate of soda:

$Na_2S_2 \rightarrow Na_2S_2O_3 \rightarrow Na_2SO_3 \rightarrow Na_2SO_4$.

The polysulphide might, however, react with any sodium cyanide present, forming sodium thiocyanate and sodium sulphide, which, in turn, would react with sodium bicarbonate to give sodium carbonate and H_2S.

$Na_2S_2 + NaCN = Na_2S + NaCNS$
$Na_2S + 2NaHCO_3 = 2Na_2CO_3 + H_2S$.

The possible formation of ammonia by oxidation of sodium cyanide might occur:

$2NaCN + 4H_2O + O_2 = 2NH_3 + 2NaHCO_3$.

A sample of foul liquor on standing was found to increase in thiocyanate content, while the oxide through which the foul gases driven off from the liquor in the actifier were passed was found to contain no ferrocyanide. The main product of cyanogen extraction was thus shown to be sodium thiocyanate, and no free hydrocyanic acid was present in the foul gases from the actifier. I shall return to this feature of the process later.

Carbonic acid, as before mentioned, is a stronger acid than sulphuretted hydrogen or hydrocyanic acid, so that sodium hydroxide will have a greater affinity for the first acid. It was shown that solid sodium carbonate will not react with sulphuretted hydrogen by passing foul gas through a **U**-tube containing the solid salt. It was then decided that the actual reactions of the acid gases with the soda ash in solution could only be effected with the hydrolyzed salt, and the primary equations must be modified as follows:

$Na_2CO_3 + H_2O = 2NaOH + H_2CO_3$
$NaOH + H_2S = NaHS + H_2O$
$NaOH + HCN = NaCN + H_2O$

The degree of hydrolysis of sodium carbonate for various dilutions is given in Table 2.

TABLE 2.

Litres of Water in which One Gramme-Molecule of Na_2CO_3 is Dissolved.	P.Ct. Na_2CO_3 in Solution.	P.Ct. Hydrolysis.	
		18° C.	25° C.
5	2·12	1·3	1·7
10	1·06	2·2	2·8
20	0·53	3·5	4·5
100	0·106	8·7	11·3
200	0·053	12·4	16·0

Sodium carbonate, therefore, hydrolyzes to the extent of 1 p.ct. in 3 p.ct. solution, and this degree of hydrolysis was quite insufficient to account for the H_2S, HCN, and CO_2 extracted from the foul gas. An analysis of commercial soda ash showed that this salt contained 4·24 p.ct. of NaOH. It was thought that this hydroxide, combined with the hydroxide by hydrolysis, might extract the impurities to the extent found in practice. By applying the formula for distribution of a base between two acids, it was found that the theoretical amount of H_2S absorbed was still much less than occurs in actual practice—indeed, the absorption of H_2S and HCN actually took place as if no carbonic acid was present.

The concentration of sodium carbonate in the original solution must be a governing factor. In accordance with Guldberg and Waage's Law of Mass Action, the reaction $2NaOH + CO_2 \rightarrow Na_2CO_3 + H_2O$ will be hindered by a high concentration of sodium carbonate. The sodium hydroxide is therefore to a great extent free to react with the H_2S and HCN. A study of the hydrolysis of sodium sulphide necessitates a further modification of the reactions previously suggested. This salt hydrolyzes to the extent of 86·4 p.ct. in a solution containing 0·78 p.ct. at 25° C., so that the recovery of NaOH from this salt may be anticipated during revivification:

$$Na_2S + 2H_2O = 2NaOH + H_2S.$$

The absorption of H_2S in the laboratory test, until the H_2S content of the solution approaches that required by the formula

$$Na_2CO_3 + H_2S = NaHS + NaHCO_3$$

can be explained by the high concentration of H_2S, which enables the reactions

$$Na_2CO_3 + 2H_2O = 2NaOH + H_2CO_3$$
$$NaOH + H_2S = NaHS + H_2O$$
$$NaOH + H_2CO_3 \rightarrow NaHCO_3 + H_2O$$

to proceed to completion.

The following reactions may therefore be expected to take place:

(1) Hydrolysis of sodium carbonate in solution:

$$Na_2CO_3 + H_2O = 2NaOH.$$

(2) Absorption of H_2S and HCN:

$$NaOH + H_2S = NaHS + H_2O$$
$$NaOH + HCN = NaCN + H_2O.$$

(3) Absorption of CS_2 and hydrolysis of resulting thiocarbonate:

$$NaHS + CS_2 = Na_2CS_3 + H_2S$$
$$Na_2CS_3 + 3H_2O = Na_2CO_3 + 3H_2S.$$

REVIVIFICATION.

(4) Oxidation of NaHS.

$$2NaHS + O = Na_2S_2 + H_2O.$$

(5) Interaction of sodium polysulphide and sodium cyanide.

$$Na_2S_2 + NaCN = NaCNS + Na_2S.$$

(6) Hydrolysis of sodium sulphide.

$$Na_2S + H_2O = 2NaOH + H_2S.$$

(7) Possible further oxidation of some of the residual NaHS.

$$NaHS \rightarrow Na_2S_2 \rightarrow Na_2S_2O_3 \rightarrow Na_2SO_3 \rightarrow Na_2SO_4$$

with liberation of sulphur.

(8) Interaction of liberated sulphur with any remaining NaCN.

$$NaCN + S \rightarrow NaCNS.$$

(9) Hydrolysis of remaining NaHS, under the influence of the air blast.

$$NaHS + H_2O = NaOH + H_2S.$$

This takes no account of the absorption of the carbon dioxide, which will take place according to the equation:

$$Na_2CO_3 + H_2O + CO_2 = 2NaHCO_3.$$

The high concentration of normal carbonate and carbon dioxide in the gas will have a retarding effect on the interaction between the bicarbonate and caustic soda, and the probability is that the bicarbonate will be reconverted into the normal carbonate during the revivification process:

$$2NaHCO_3 = Na_2CO_3 + H_2O + CO_2.$$

POSSIBILITIES OF THE PROCESS.

There are three main channels which need investigation:

I. More complete absorption of H_2S from the unpurified gas.

II. Thiocyanate recovery.

III. Disposal of foul gases from the actifier.

I. ABSORPTION OF SULPHURETTED HYDROGEN.

If the reactions were simply of the reversible type, as set forth in Sperr's paper, the circulation of 1500 gallons of 3 p.ct. soda ash solution at the rate of 3000 gallons per hour, as practised at Southport, would be sufficient to remove a much larger proportion of sulphuretted hydrogen from the crude gas. Unfortunately, the reactions are not so simple; and to ensure success with gas containing upwards of 500 grains H_2S per 100 c.ft., one must resort to some method of speeding-up the process. Having regard to the inhibiting action of the sodium carbonate upon the absorption of carbon dioxide by the sodium hydroxide formed by hydrolysis, it is suggested that the addition of sodium hydroxide might be feasible, with a corresponding reduction in the amount of soda ash used, to keep the cost of the process within reasonable limits. Further investigation should reveal the point at which the sodium carbonate concentration is just sufficient to keep down the absorption of carbon dioxide by the caustic soda present, so that the maximum percentage of sulphuretted hydrogen would be removed from the crude gas.

II. THIOCYANATE RECOVERY.

Mr. Cook, in his paper above mentioned, has drawn attention to the advantages of cyanogen removal by the soda ash process, by the elimination of one of the most potent causes of corrosion. The analysis of deposit from a 1¼-in. service pipe in Southport gave cyanogen, estimated as Prussian blue, 9·84 p.ct., or, as hydrocyanic acid, 4·41 p.ct., showing what an important factor this impurity is in the stoppage of mains and services. The final product from the removal of this compound is sodium thiocyanate, which accumulates in the washing liquor and finally finds its way to the concentrated liquor plant, increasing the thiocyanate content of the effluent from that plant. Profitable recovery of this compound would thus serve the double purpose of decreasing the costs of the purification process and eliminating a noxious agent from the ammonia plant effluent.

With this object in view, the following test was carried out: At 3.40 p.m. on July 5, 1927, the liquid purification plant commenced working. At 9 a.m. on July 11 a sample of the actified liquor was taken from the tank and tested for thiocyanate. 400 c.c. of the liquor was boiled in a conical flask to expel H_2S, and the resultant liquor saturated with sulphur dioxide and treated with excess copper sulphate solution. The white precipitate of copper thiocyanate was filtered off, dried, and weighed. A yield of 54 grammes of copper thiocyanate was obtained, equivalent to 1410 lbs. per 1000 gallons of liquor. During the test period, 7¾ million c.ft. of gas had passed through the plant, showing that an absorption of 38 grains of HCN per 100 c.ft. of gas had been effected. The thiocyanate content of the actified liquor was equivalent to 1328 lbs. per 1000 gallons.

The commercial possibilities of thiocyanate extraction by means of copper sulphate seem worthy of investigation; 1410 lbs. of copper thiocyanate would require 1970 lbs. of copper sulphate crystals. The market price of copper sulphate crystals was at this period £25 per ton, and that of copper thiocyanate £104 per ton; 1000 gallons of liquor would thus require copper sulphate crystals to the value of £22, and theoretically would yield copper thiocyanate to the value of £65. Copper thiocyanate is used in the dyeing and calico printing industries, while thiocyanate is of importance in the artificial silk industry.

The requisite heating and saturation of the liquor could be effected by passing waste chimney gases through it, after which thorough mixing with copper sulphate solution would effect the precipitation of the thiocyanate. The H_2S driven off during the heating of the liquor could be passed under the boiler and burnt, to give a further supply of sulphur dioxide.

III. DISPOSAL OF FOUL GASES FROM THE ACTIFIER.

The disposal of these gases could also be effected, as proposed by the inventors of the soda ash process, by combustion beneath the boilers.

EFFLUENT DISPOSAL.

Though somewhat foreign to the subject of this paper, a method for dealing with the effluent from sulphate and concentrated ammonia plants is here demonstrated. Dephenolation by means of chimney gases leaves the effluent in the required condition, saturated with sulphur dioxide, for the economic recovery of thiocyanates. The resultant liquor, freed from copper, would have little effect on bacteria beds, and the sale of the extracted thiocyanate might have the effect of transforming the treatment of effluent from a matter of fairly heavy expenditure to a source of revenue. A laboratory test shows that the passage of sulphur dioxide through effluent decolourizes it, and the addition of copper sulphate solution to the filtered resultant solution precipitates copper thiocyanate in a pure white form.

The recovery of thiocyanate from effluent by means of copper salts has been mentioned in the First Report of the Liquor

Effluents Research Committee, but the small percentage of this compound, 0·16 p.ct., has been against its success as a commercial proposition. Taken in conjunction with the dephenolation method it might perhaps be worthy of trial.

APPENDIX.

Absorption of H_2S and HCN at Southport, December, 1925.

Average make per day . . . . . 2,040,000 c.ft.
" " " half-hour . . . . . 42,500 "

H_2S—Average at inlet of liquid purification plant. . . . . 650 grains per 100 c.ft.
= 276,250 grains passing per ½-hour
= 8125 grain-molecules per ½-hour

HCN—Average at inlet of liquid purification plant. . . . . 36 grains per 100 c.ft.
= 15,300 grains passing per ½-hour
= 567 grain-molecules per ½-hour

CS_2—Average at inlet of liquid purification plant . . . . . 33 grains sulphur per 100 c.ft., or 78 grains CS_2 per 100 c.ft.
= 16,570 grains passing per ½-hour
= 432 grain-molecules per ½-hour

Soda ash solution—1500 gallons containing 450 lbs. of soda ash are circulated at the rate of 3000 gallons per hour . . . . . = 1500 gallons per ½-hour
= 450 lbs. soda ash per ½-hour
= 19·08 lbs. NaOH (by analysis)

We have also 3·15 lbs. NaOH by hydrolysis of the sodium carbonate, so that a total of 22·23 lbs. NaOH are present at the beginning of the period. This equals 155,610 grains NaOH, or 3890 grain-molecules NaOH.

In practice 240 grains H_2S per 100 c.ft. are extracted . . . . = 3000 grain-molecules per ½-hour.
In practice 24 grains HCN per 100 c.ft. are extracted . . . . = 377 grain-molecules per ½-hour.
In practice 52 grains CS_2 per 100 c.ft. are extracted . . . . = 288 grain-molecules per ½-hour.

From the formulæ $NaOH + H_2S = NaHS + H_2O$
$NaOH + HCN = NaCN + H_2O$
$2NaHS + CS_2 = Na_2CS_3 + H_2S$
$Na_2CS_3 + 3H_2O = Na_2CO_3 + 3H_2S$

we find that 377 grain-molecules of NaOH are lost by the extraction of HCN and formation of thiocyanate, while 576 grain-molecules of NaHS, corresponding to 576 grain-molecules of NaOH, are lost in the extraction of CS_2; the NaOH from the hydrolysis of the resultant sodium carbonate from the latter being negligible. A total of 953 grain-molecules are therefore lost, the remainder being reconverted into NaOH.

The total caustic soda used up in the absorption of sulphuretted hydrogen and hydrocyanic acid equals 3377 grain-molecules. This leaves 3890 − 3377 —*i.e.*, 513—grain-molecules of NaOH. There is thus a deficit of 440 grain-molecules; but further hydrolysis of the sodium carbonate yields 550 grain-molecules NaOH, so that there is still a surplus.

In actual practice, of course, the fouling and actification of the liquor proceed simultaneously, but the above demonstrates the gradual weakening of the solution.

To my mind, the above results appear to favour the sodium hydroxide theory.

Prof. Burstall Discusses the Present Position of the World's Fuel.

There was a large attendance of members of the Midland Junior Gas Association at their meeting, on Jan. 9, at the Council House, Birmingham. The occasion was of special interest in that the "talk" was on the "Present Position of the World's Fuel," by Prof. F. W. Burstall, Vice-Principal of the University of Birmingham, and Head of the Mechanical Engineering Department.

Prof. Burstall pointed out that practically all the fuels used to-day are some form of carbon. In the earlier periods of our history, our main fuel was wood, and in the fourteenth century the Midland area, like many others, was covered with forests. Late in the fifteenth century there appeared to have been some apprehension regarding the available supplies of wood in view of the country's increasing requirements, and by an order of the Government the further cutting-down of trees was stopped, and it became necessary to import wood for the construction of ships. A little later on, coal, which was at the time called "burning stone," was discovered, and its use spread rapidly. In the early period of the reign of Henry VIII. "sea-cole" was used to a fairly large extent in London, to which it could be brought by ships, but there was great objection to it because of the noxious smell and smoke it produced. As time went on the employment of coal became more general for the purposes of cooking and affording heat, but it was little used in manufacturing processes until the introduction of the blast furnace by Dud Dudley in 1680.

Prof. Burstall then discussed the various kinds of coal, and stated that the requirement was to get the fuel to develop heat with the utmost rapidity. He thought one of the great reasons for later industrial developments was an appreciation of this fact by the remarkable men who lived in the eighteenth century, three of whom had their homes in Birmingham—Watt, Murdoch, and Boulton. He viewed Murdoch with even more veneration than he did Watt, not because of his introduction of gas, but because of his remarkable versatility. He was a man who first started the use of the air compressor, and it might truly be said that Murdoch had left his mark on every part of mechanical engineering. Murdoch foresaw in his experiments on coal the remarkable flexibility which the gaseous substances possessed over the liquid or the solid fuels. It was on that one fact that the pre-eminent position of the gas industry depended. It was an indisputable fact that they have this wonderful flexibility of this gaseous substance, which burned without any trouble and without any loss in the way of incomplete combustion, providing it was properly arranged.

Prof. Burstall then directed attention to the second process in the history of fuel—oil. The presence of oil had long been known in the East, in Persia and elsewhere, because there had been spontaneous outbursts of flame from the earth. These outbursts gave rise to a form of worship, including the Adoration of the Pillar of Fire. Having described the oil pools and their characteristics, and pointed to the extraordinarily varying qualities of oil in different countries and areas, he explained that oil mining had marked points of difference from coal mining. From the beginning the oil was used for illuminating purposes. In recent years the introduction of the internal combustion engine for road propulsion had given to oil an enormous impetus, and since 1896 there had been a demand for light spirit which was not previously known. The next big move was the introduction, first of the heavy oil engine, and, secondly, of the use of crude oil for boiler firing. Oil was now being used on ships of war, but he thought there was a likelihood of this position being reversed, and that coal would again be employed.

Great Britain produced 241 million tons of coal, with a population of 42 millions, while the production in the United States was 517 millions with a population of 120 millions. In regard to oil production, the British Empire made a very poor show. The total of the British Empire was only 2 p.ct. of the oil production of the world, while coal production was greater by far than that of any other country. "I think at the present time we ought, to use a familiar phrase, to put our shirts on coal, and not on oil," observed Prof. Burstall. "I will go further, and say that nothing would be more beneficial to this country than the drying-up of the oil supplies of the world. I believe the use of pulverized coal is likely to revolutionize marine propulsion."

VOTE OF THANKS.

Mr. C. M. D. BELTON (Shrewsbury), President of the Midland Association of Gas Engineers and Managers, in moving a vote of thanks to Prof. Burstall, said they were extremely fortunate with regard to the coal supplies in this country.

The resolution was seconded by Mr. A. W. SMITH, General Manager and Secretary of the Birmingham Gas Department.

Tars (Nos. 1 and 2) for Road Purposes.—The British Engineering Standards Association has now issued a revised British Standard Specification for Tars (Nos. 1 and 2) for Road Purposes which represents a considerable advance upon the Ministry of Transport (Roads Department) Specifications issued as British Standard Specifications in April, 1928. The Specification now issued has been prepared by the British Road Tar Association, and, having been considered and approved with slight modifications, is now issued by the British Engineering Standards Association as a British Standard Specification and has the full support of the Ministry of Transport. It covers, as formerly, tar for the surface tarring of roads and for making tarmacadam. The methods of testing and specifications for apparatus contained in appendices have been specially prepared by the Standardization of Tar Products Tests Committee. They provide for the determination of every property of the tar covered by the Specification and are prescribed in much greater detail than in the Specification No. 76—Part 1, 1928, now superseded. Copies of the new Specification (No. 76—1930) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W. 1, price 2s. 2d., post free.

Parliamentary Intelligence.

Notices Given of Bills (Session 1930) Relating to Gas.

Ascot District Gas and Electricity Company.—To convert the existing capital of the Company; to authorize the raising of additional capital; and for other purposes. The proposal is to convert 6000 original £10 shares into sliding-scale stock, at the rate of £20 of stock for each £10 share; 2938 £10 shares (1906 issue) into sliding-scale stock, at the rate of £14 of stock for each £10 share; 2930 £10 shares (1926 issue) into maximum dividend stock, at £10 of stock for each £10 share; and 7866 £10 preference shares into £78,660 of preference stock bearing a fixed preferential dividend of 6 p.ct.; sliding-scale stock to be entitled to a standard dividend of 5 p.ct. based on a standard price for gas of 15·8d. per therm; and maximum dividend stock, to 7 p.ct., subject to a proportionate reduction if the dividend on the sliding-scale stock falls below 5 p.ct.

Birkenhead Corporation.—Part VIII. of the Bill applies sections 20 to 29 of the Weights and Measures Act, 1889, to the sale of coke; imposes a penalty of £5, or £10 for a second offence, on the fraudulent sale of coke; and empowers any Inspector of Weights and Measures to take proceedings with the consent of the Corporation. These provisions apply also to any solid fuel derived from coal, but not to coke sold at the Corporation gas-works. Provisions applying the Weights and Measures Act, 1889, to the sale of coke, and laying down penalties for its fraudulent sale, appear also in Bills promoted by the Bristol Corporation and the Middlesex County Council.

Brighton and Hove General Gas Company.—To convert £10,000 of 4 p.ct. "C" preference consolidated stock into 6 p.ct. "B" preference consolidated stock, at the rate of £66 13s. 4d. of "B" stock for each £100 of "C" stock; and the 4 p.ct. perpetual debenture stock into 5 p.ct. perpetual debenture stock, at the rate of £80 of 5 p.ct. stock for each £100 of 4 p.ct. stock. The converted stock to rank for all purposes with the existing stocks.

Brixham Gas Company.—To convert all the ordinary capital of the Company into ordinary £1 shares, entitled to a standard dividend of 5 p.ct. Power is taken to raise additional capital not exceeding £20,000. One-fourth of each future issue of capital is to be reserved for offer to consumers and employees. There is power to supply electricity in the Broad Sands district of Paignton; and the name of the Company is to be changed to the Brixham Gas and Electricity Company.

Rotherham Corporation.—Among other matters, further provisions are made with regard to the gas and electricity undertakings.

South Staffordshire Mond Gas Company.—To amend certain provisions relating to the sale of gas, and for other purposes. The Bill provides that the Gas Regulation Act of 1920 and the Gas Undertakings Act of 1929 shall not apply, and shall be deemed never to have applied, to the Company. In the preamble it is stated that the statutory conditions regulating the supply of gas by the Company differ materially from those regulating undertakers supplying gas for use in private dwelling-houses, and that the Company is believed to be the only one supplying gas under statutory powers solely for industrial purposes.

South Yorkshire and Derbyshire Gas Company.—To provide for the amalgamation of the undertakings of the Dinnington and District Gas Company, Ltd., Staveley Gas Light and Coke Company, Ltd., Whitwell and District Gas Company, Bawtry and District Gas Company, Beighton and District Gas Company, and Maltby and Bramley Gas Company; to incorporate and confer powers on the South Yorkshire and Derbyshire Gas Company and vest in that Company the amalgamated undertakings; and for other purposes. The Bill provides for the creation of £165,305 original capital in ordinary stock and £11,662 additional capital, and for its allocation to the registered shareholders in the six Companies on the terms set out. The new Company are empowered to purchase the following gas undertakings, so far as they are within the limits of supply: Shireoaks Colliery Company, Ltd., Tickhill Gas Light and Coke Company, Ltd., Gringley and District Gas and Coal Company, and Thorne Gas Light and Coke Company, Ltd.

Southport Corporation.—Part III. of the Bill includes clauses dealing with the supply of gas fittings, &c., and the use of geysers.

Stoke-on-Trent Corporation.—Among other provisions, there are clauses relating to the extension of the Corporation's limits for the supply of gas so as to include the borough of Newcastle-under-Lyme, the urban district of Wolstanton United, and the parishes of Clayton and Keele.

West Bromwich Corporation.—A General Bill making provision for the extension of the Corporation's limits of supply for gas to added parts of Walsall and Great Barr.

PROVISIONAL ORDER.

Glasgow Corporation.—A Provisional Order for which the Corporation are making application to the Secretary of State for Scotland contains provisions to authorize the purchase of bulk supplies of coke oven gas, and the laying of the necessary mains and pipes for the purpose of conveying these supplies to the gas-works of the Corporation.

Gas Acts (1920 and 1929) Orders.

SECTION 6.

Bridgnorth Corporation.

The Corporation shall, from April 1, charge according to the number of B.Th.U. supplied.

The maximum price of gas shall be 12d. per therm. The words "7·2d. per therm" shall be substituted for "3s. per 1000 c.ft." in Article XXVI. of the Bridgnorth Gas Order, 1881; and the price of 12d. per therm for 5s. per 1000 c.ft. in Article XXVIII. of the Order.

Kingston-upon-Hull Corporation.

The Corporation shall, from April 1, charge according to the number of B.Th.U. supplied.

Stafford Corporation.

The Corporation shall, from April 1, charge according to the number of B.Th.U. supplied.

The maximum price of gas shall be 13·2d. per therm.

SPECIAL ORDERS.

Bedford District Gas Company.

To make capital and other provisions.

Solihull Gas Company.

To authorize the raising of additional capital.

DECLARATIONS OF CALORIFIC VALUE.

(April 1, 1930.)

Atherton Urban District Council.—440 B.Th.U. (March 31.)
Bangor Corporation.—450 B.Th.U.
Bridgnorth Corporation.—470 B.Th.U.
Colwyn Bay Urban District Council.—450 B.Th.U.
Darlington Corporation.—470 B.Th.U.
Dukinfield Corporation.—500 B.Th.U.
East Ardsley Gas Company.—500 B.Th.U.
Egremont Urban District Council.—425 B.Th.U. (Jan. 1.)
Evesham Corporation.—600 B.Th.U.
Goole Urban District Council.—420 B.Th.U.
Grange and Cartmel District Gas and Water Works Company.—450 B.Th.U.
Great Grimsby Gas Company.—500 B.Th.U.
Honley Urban District Council.—475 B.Th.U., in substitution for 500 B.Th.U. (March 31.)
Huddersfield Corporation.—500 B.Th.U.
Kingston-upon-Hull Corporation.—460 B.Th.U.
Meltham Urban District Council.—500 B.Th.U.
Milford Haven Urban District Council.—490 B.Th.U.
Newcastle-under-Lyme Corporation.—470 B.Th.U.
New Hunstanton Urban District Council.—500 B.Th.U.
Northwich Gas Company.—500 B.Th.U.
Oldham Corporation.—475 B.Th.U.
Prestatyn Urban District Council.—500 B.Th.U.
Ramsgate Corporation.—500 B.Th.U.
Risca Urban District Council.—500 B.Th.U.
Sedgley Urban District Council.—425 B.Th.U.
Selby Urban District Council.—480 B.Th.U.
Shepshed Urban District Council.—500 B.Th.U.
Sittingbourne District Gas Company.—500 B.Th.U., in substitution for 475 B.Th.U.
Stafford Corporation.—440 B.Th.U.
Stalybridge Corporation.—500 B.Th.U.
Wolstanton United Urban District Council.—470 B.Th.U.
Worcester New Gas Light Company.—475 B.Th.U.

Diaries, Calendars, &c.

Further seasonable gifts in the form of diaries, calendars, &c., have been received from the following firms:

Alder & Mackay, Ltd., New Grange Works, Edinburgh.
Brotherton & Co., Ltd., City Chambers, Leeds.
Cambrian Wagon Company, Ltd., East Moors Road, Cardiff.
Crossley Bros., Ltd., Openshaw, Manchester.
Davison & Partner, Ltd., 11, Carteret Street, S.W. 1.
Dougalls Gas Meters, Ltd., Chiswick Mall, W. 4.
Gas Light and Coke Company.
Gibbons (Dudley), Ltd., and Gibbons Bros., Ltd., Dudley.
Guppy, William, & Son, Ltd., 2-3, Eldon Street, E.C. 2.
Hazell, Watson, & Viney, Ltd., 52, Long Acre, W.C. 2.
King's Patent Agency, Ltd., 146A, Queen Victoria Street, E.C. 4.
Lunt Bros., Colmore Row, Birmingham.
Peckett & Sons, Ltd., Bristol.
Simon-Carves, Ltd., 20, Mount Street, Manchester.
Stanton Ironworks Company, Ltd., nr. Nottingham.
Tollit & Harvey, Ltd., Bush House, W.C. 2.
United Steel Companies, Ltd., Sheffield.
Whessoe Foundry and Engineering Company, Ltd., Darlington.
Wimborne Minster Gas Company, Ltd.

Register of Patents.

Right or Left Hand Geysers.—No. 322,883

EWART, J. H., and EWART, J. W., both of Crouch End, N. 8.

No. 35,208; Nov. 29, 1928.

With geysers at present in use, in order to convert a geyser where the burner swings in one direction only, into a geyser in which the burner can swing in the opposite direction various connections must be modified by the mechanic when erecting and fitting the geyser, and considerable extra work is thereby incurred.

The object of this invention is to provide a geyser in which such disadvantages are obviated. There is provided a geyser so constructed that the gas burner may be swung outwardly to either side of the water chamber at will.

A geyser constructed according to this invention may be fitted into any corner of a bathroom, so that, if there is an obstructing wall on one side of the geyser, the burner may be swung in the reverse direction without necessitating any interchanging of parts.

Portable Gas Fire.—No. 322,838.

MACLAY, J. A., of Glasgow, and R. & A. MAIN, LTD., of Grosvenor Gardens, S.W. 1.

No. 28,690; Oct. 5, 1928.

The idea of this invention is to provide a portable gas fire which may be located in front of an existing firegrate and which, when not in use, may be converted into a screen.

Fig. 1 is a front view of the fire showing the door in position; fig. 2 is a front view showing the door and trivet plate removed; fig. 3 is a side view showing the door tilted forward as in the act of its being removed; fig. 4 is a back view; and fig. 5 is a vertical section on the line 5—5 of fig. 1.

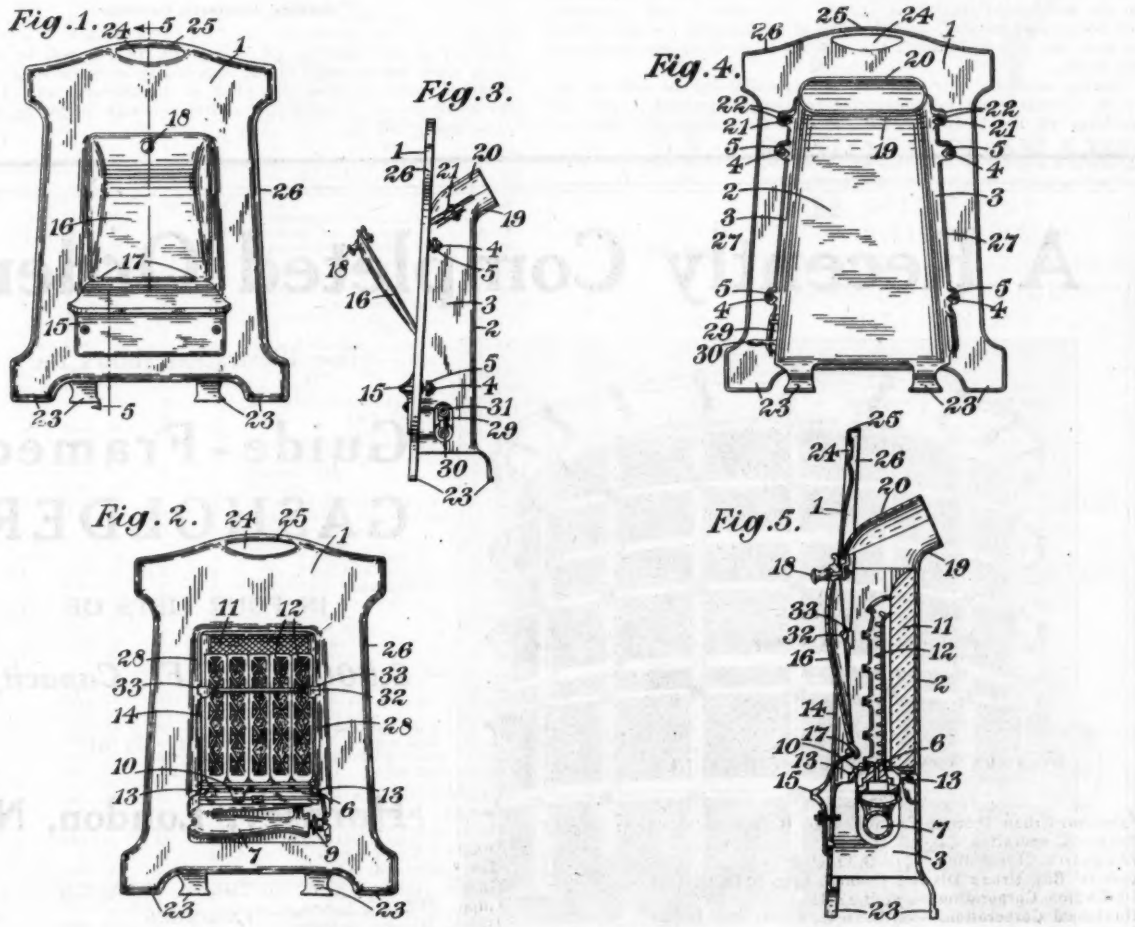
The gas fire comprises an apertured front plate 1 which is substantially flat and is formed from a light casting. A back plate 2 having two side plates 3, 3 cast integral with it is secured to the front plate by studs 4 which are fixed in the back of the front plate and extend through the lugs 5 on the side plates. A heating unit is secured between the front plate and the back plate. The heating unit comprises a burner 6 and mixing chamber 7 beneath it, an injector nozzle 9, a fuel plate 10, a firebrick back 11 and radiants 12. The fuel plate rests on projections 13 formed on the back plate and the front plate. The other parts of the unit are all secured to or rest on the fuel plate. The aperture 14 in the front plate is of such a size as to expose the burner, firebrick back, and radiants. The lower part of the aperture in which the burner is situated is closed by a detachable trivet plate 15. When the trivet plate is in position a substantially rectangular aperture is left in the front plate. This rectangular aperture is closed by a light cast-iron door 16. Two lugs 17 spaced apart on the back of the door are arranged to project downwardly so that they may be inserted behind the top edge of the trivet plate while the top of the door is provided with a swivelling latch 18 which engages with the top edge of the rectangular aperture and thus retains the door in position.

The upper part of the back plate 19 is directed away from the front plate and forms the lower part of a flue conduit. The upper part 20 of the flue conduit, which also comprises the canopy, is formed separately and is secured to the bottom part by means of bolts 21 which are arranged to pass through lugs 22 formed on the upper and lower parts of the conduit. The upper part of the conduit extends rearwardly from the top edge of the aperture.

The lower extremities of the front plate and the back plate are provided with feet 23. An oval hole 24 is so formed in the upper part of the front plate that the metal left between the hole and the upper edge of the plate forms a handle 25 by which the stove may be carried.

A rearwardly directed strengthening flange 26 is formed on the outer edge of the front plate. A rearwardly projecting rib 27 is formed on the back of the front plate for the purpose of locating the side plates. The vertical edges of the aperture are provided with flanges 28 directed backwardly for locating the firebrick back in position.

Viewed from the rear, the back plate tapers from the bottom to a smaller breadth at the top. The side plates taper in a similar



MACLAY & MAIN'S PORTABLE GAS FIRE.

manner. The feet on the front plate and back plate are so dimensioned as to effect a slight rearward tilt of the front plate.

A hole 29 is formed towards the bottom of one of the side plates through which hole projects the gas supply pipe 30 and injector regulating screw 31.

A bar 32 for retaining the radiants in position is disposed across the aperture and is located in slots 33 formed in the edges of the aperture.

Automatic Gas Governing.—No. 322,887.

PEEBLES, W. C., and PEEBLES & Co., LTD., a British Company, both of Edinburgh.

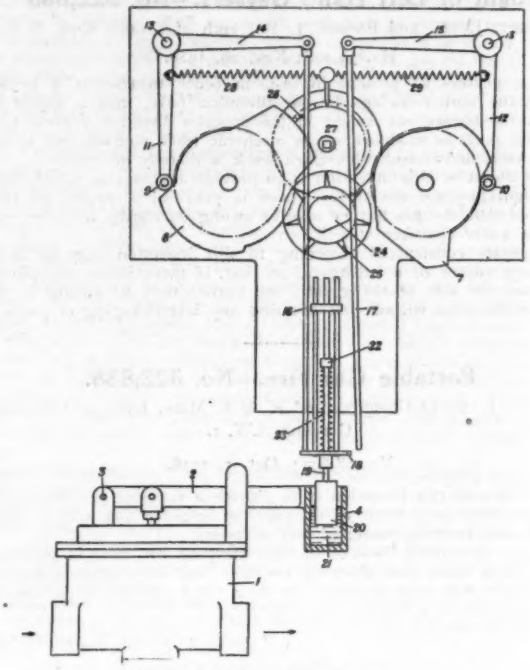
No. 35,971; Dec. 6, 1928.

This invention comprises a gas governor device to which the loading of the main governor by air or gas pressure through a pilot governor is varied by alternately operative cams driven by clockwork and co-operative with follower mechanism associated with the pilot governor device and adapted to be rendered operative automatically in turn at predetermined intervals of time.

Referring to the drawing, 1 denotes an auxiliary gas governor of which the valve (not shown) is controlled by a lever 2 pivoted at one end at 3 and carrying on its other end a mercury-containing cup 4.

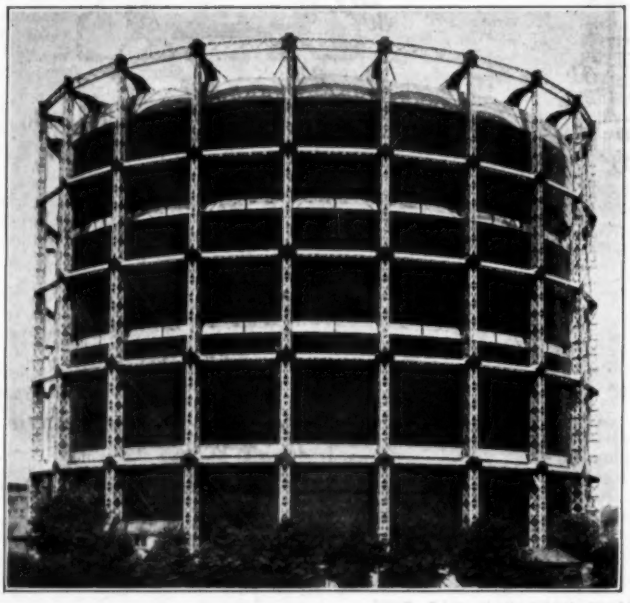
Disposed above the auxiliary governor 1 is a pair of clockwork driven cams 6, 7 constituting, respectively, a week-day cam and a Sunday cam adapted to be brought into operation selectively. Co-operating with the cams 6, 7 are followers 9, 10, respectively, carried by arms 11, 12 of a pair of bell-crank levers pivoted at 13. Operatively connected to the other arms 14, 15 of the bell-crank levers is a pair of depending rods 16, 17, respectively, at the lower ends of which is disposed a platform 18 carried by a dipping rod 19 guided to perform vertical movement and carrying on its lower end a mass 20 immersible in mercury 21 in the cup 4. Surrounding the dipping rod 19, and interposed between the platform 18 and a stationary guide 22, is a light helical spring 23. Interposed between and engaging the rods 16, 17, about midway of the height thereof, is a cam 24, unitary with which is a star wheel 25 engageable by a striker 26 driven by a clock 27 which serves also to drive the cams 6 and 7. The followers 9, 10 are maintained in engagement with their cams 6, 7, respectively, by helical tension springs 28, 29 acting on the bell-crank lever arms 11, 12. The cams 6 and 7 perform one revolution per day, and the striker 26 engages the star wheel 25 once per day and causes the cam 24 to perform one revolution per week.

During week-day operation the cam 24 maintains the rods 16 and 17 in operative and in inoperative relation, respectively, with the platform 18, as shown, so that the cam 6 regulates the depth of immersion of the mass 20 in the mercury 21 through the intermediary of the train 9, 11, 14, 16, 18, and 19; the auxiliary governor 1 being thereby variably loaded in accordance with the contour of the cam 6. On Sunday, the cam 24 moves the rod 16 into inoperative relation with the platform 18 and allows the rod 17 to move into operative relation with said platform, so that the cam 7 may regulate the depth of immersion of the mass 20, through the intermediary of the train 10, 12, 15, 17, 18, 19. It will be understood that, while one or other of the rods 16, 17 is operative, the inoperative rod rises and falls idly, clear of the platform 18. The spring 23 is alternately stressed and unstressed with ascent or descent of the dipping rod 19.



Peebles' Automatic Governor.

A Recently Completed Order



The Illustration shows the

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STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr.	Dividends. Last Hf. Yr.	NAME.	Quotations. Jan. 10.	Rise or Fall on Week.	Transactions Lowest and Highest Prices During the Week.
£			% p.a.	% p.a.				
171,978	Stk.	Aug. 15	5	5	Aldershot 5 p.c. max. C.	70—75	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	71—74	..	..
1,551,868	,,	Sept. 26	7⅜	7⅜	Alliance & Dublin Ord.	93—96	..	94½—95
374,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	60—63*	−2	..
522,655	,,	Aug. 29	7	7	Barnet Ord. 7 p.c.	112–115	..	114–115
300,000	1	Oct. 24	1/4⅛	1/4⅛	Bombay, Ltd	16/- 18/-	..	17/-
172,500	10	Aug. 29	8½	9	Bournemouth 5 p.c.	13—13½	+½	12⅝
500,050	10	,,	7	7	Do. 6 7 p.c.	12⅜—12⅝	..	..
439,160	10	,,	6	6	Do. Pref. 6 p.c.	10½—11	..	11—11,⅜
50,000	Stk.	Dec. 19	3	3	Do. 3 p.c. Deb.	53—56	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	+1	73–74⅜
357,900	,,	Aug. 29	7½	7½	Brighton & Hove 6 p.c. Con	113–116	..	..
871,880	,,	,,	6⅜	6⅜	Do. 5 p.c. Con.	100—103	..	..
1,287,500	,,	July 25	5	5	Bristol 5 p.c. max.	85—87a	−2	..
855,000	,,	Sept. 12	7½	7	British Ord.	112—117	..	112
100,000	,,	Dec. 19	7	7	Do. 7 p.c. Pref.	109—114	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	69—71	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	92—95	..	..
100,000	,,	Jan. 9	5	5	Cambridge 5 p.c. Deb.	88—91*	−2	..
100,000	10	Dec. 5	8	6	Cape Town, Ltd	8⅜—9½	..	..
100,000	10	Nov. 7	4½	4½	Do. 4½ p.c. Pref.	6½—7½	..	..
150,000	Stk.	Dec. 19	4½	4½	Do. 4½ p.c. Deb.	69—74	..	..
626,860	,,	July 25	6	6	Cardiff Con. Ord.	98—101	..	..
237,860	,,	Jan. 9	7½	7½	Do. 7½ p.c. Red. Deb.	97—100*	−2	..
157,150	,,	Aug. 15	6½	5	Chester 5 p.c Ord.	87—92b	..	..
98,986	1	Oct. 10	†2/-	†2/	Colombo, Ltd. Ord.	34/—36/-	..	..
24 495	1	,,	1/1⅛	1/1⅛	Do. 7 p.c. Pref.	19/—21/-	..	..
375,402	1	Oct. 10	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord.	23/6—25/6	..	24/-
187,848	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,073,280	Stk.	July 25	7	5	Commercial Ord.	90—95	..	..
475,000	,,	Dec. 19	3	3	Do. 3 p.c Deb	54—57	..	..
787,560	,,	Aug. 15	7	7	Croydon sliding scale	104—107	..	..
403,100	,,	,,	5	5	Do. max. div.	80—85	..	..
542 270	,,	Aug. 29	10	7	Derby Con.	118—121e	..	..
55,000	,,	Dec. 19	4	4	Do. Deb.	67—70e	..	..
209 000	..	Aug. 29	5	5	East Hull Ord. 5 p.c.	73—75	..	..
1,002,180	10	Sept. 12	†7	†4	European, Ltd.	12½—14½	..	13–13½
18,708,480	Stk.	July 25	5⅜	5⅜	Gas Light & Coke 4 p.c. Ord.	18/1⅛—18/7½f	+-/4½	17/10½ - 18/6
2,600,000	,,	,,	3⅜	3⅜	Do. 3½ p.c. max.	60—62	..	60½ - 62
4,157 020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	74–77	+1	74½—77
5.602,620	,,	Dec. 19	3	3	Do. 3 p.c. Con. Deb.	56—58	..	56½ - 58
3,642.770	,,	,,	5	5	Do. 5 p.c. Red. Deb	97—100	..	98—99
82,500	,,	Aug. 29	7	7	Hastings & St. L. 5 p.c. Conv.	98–103	..	..
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	77—82	..	..
70 000	10	Oct. 10	†10	†10	Hongkong & China, Ltd.	13½–14½	..	..
213,200	Stk.	Aug. 29	6	6½	Hornsey Con. 3½ p.c.	84–87	..	..
1,976,000	,,	Nov. 21	20	10	Imperial Continental Gas.	345—365	+15	330 358½
223,180	,,	Aug. 15	3½	3½	Do. 3½ p.c. Red. Deb.	71–76	..	..
235,242	,,	Aug. 15	7½	8	Lea Bridge 5 p.c. Ord.	115—118	..	116
2,145,907	,,	Aug. 15	6½	6	Liverpool 5 p.c. Ord.	91—92b	..	..
600,000	,,	Sept. 26	7	7	Do. 7 p.c. Red Pref.	100½—102½b	..	..
165,736	,,	Aug. 29	8	9	Maidstone 5 p.c. Cap.	122–127	..	124½—126
63,480	,,	Dec. 19	3	3	Do. 3 p.c. Deb.	52—55	..	..
75,000	£5	Dec. 5	†10	†10	Malta & Mediterranean	5½—6	..	..
392,000	—	Oct. 1	5½	5½	Metrop'itan (of Melbourne) 5½ p.c. Red. Deb.	92—95	..	..
541,920	Stk.	Nov. 21	†9	†6	Montevideo, Ltd.	105—110	+3	..
2,061,315	,,	July 25	5⅜	5	Newcastle & Gateshead Con.	15/9—16/3d	−6	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	71⅜—72½d	..	..
691,705	,,	Dec. 19	3½	3½	Do. 3½ p.c. Deb.	65½—66½d	..	..
131,780	,,	Aug. 29	7/1/0	7/1/0	North Middlesex 6 p.c. Con.	112—117	..	..
396,160	,,	Aug 15	5	5	Northampton 5 p.c. max.	76—79	..	..
300,000	,,	Nov. 21	7	9	Oriental, Ltd.	108—113	..	111—'12
60,000	5	13 My., '15	—	—	Ottoman	0—¼	..	..
205,162	Stk.	Jan. 9	8	8	Plym'th & Stonehouse 5 p.c.	107 - 110*	−3	..
424,416	,,	Aug. 29	8½	8	Portsm'th Con. Stk. 4 p.c. Std	113–118	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	80—83	..	..
2 234,464	1	June 27	—	‡5	Primitiva Ord.	28/—30/-	+1/6	..
244,500	100	Dec. 2	4	4	Do. 4 p.c. Red Deb.	91—94	..	..
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79–82	..	..
416,345	,,	Dec. 19	4	4	Do. 4 p.c. Cons. Deb.	77—80	..	..
150,000	10	Sept. 26	6	6	San Paulo 6 p.c. Pref.	8½—9	..	..
1,736 968	Stk.	Aug. 29	6¾	6½	Sheffield Cons.	104—106e	..	..
95,000	,,	Jan. 9	4	4	Do. 4 p.c. Deb.	74—76*	−1	..
90 000	10	June 13	‡4	‡4	South African	4—6	..	..
6,609,895	Stk.	July 26	7½	5	South Met. Ord.	99—101	..	99¼—100½
500,000	,,	,,	6	6	Do. 6 p.c Irred. Pf.	106—109	..	106½
1,895 445	,,	Jan. 9	3	3	Do. 3 p.c. D b.	53—56*	−1	..
734,000	,,	Sept 12	6¼	6½	Do. 6½ p.c. Red. Db.	98—100	..	..
91.500	,,	Aug. 15	8½	8½	South Shields Con.	109—111d	..	..
1,543,795	,,	July 25	6⅜	6⅜	South Suburban Ord. 5 p.c.	101—104	..	..
498,837	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	92—95	..	95
647.740	,,	Aug. 15	5	5	Southampton Ord. 5 p.c. max.	77—80	..	78½—79½
121 275	,,	Dec. 19	4	4	Do. 4 p.c. Deb.	68—71	..	..
179,014	,,	July 25	8	8	Sutton Ord.	116—119	..	..
67,828	,,	Jan. 9	5	5	Do. 5 p.c. Deb.	88—91*	−2	..
250,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red Pref.	100—102	..	..
200,000	,,	Dec. 19	6½	6½	Do. 6½ p.c. Red. Deb.	97—99	..	..
1,092,275	,,	Aug. 15	6⅝	6⅝	Tottenham District Ord.	101 - 106	..	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
184,255	,,	Dec. 5	4	4	Do. 4 p.c. Deb.	72—75	..	..
193.380	10	30 Dec., '12	—	—	Tuscan, Ltd.	3¼—4½	+2	..
85,701	Stk.	Sept. 26	6	6	Do. 6 p.c. Red. Deb.	75—80	+5	..
280,094	,,	Aug. 29	7	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	97—102	..	100
88,336	,,	,,	5	5	Do. 5 p.c. pref.	85–90	..	..
1,18?,970	,,	—	—	—	Wandsworth, Wimbledon, and Ely sm Cons.	105—110	..	..
200,000	,,	July 11	5	5	Do. 5 p.c. Pref.	87—92	..	..
482,344	,,	Dec. 19	5	5	Do. 5 p.c. Deb.	91—95	..	93½

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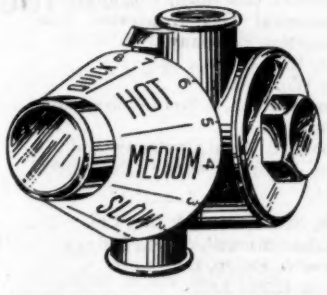

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ASSISTANT Secretary and Accountant, with Knowledge of Shorthand, wanted for Gas Office—a "young" man to TAKE CHARGE. Must be smart and alert. Preference given to a man having had Experience in Control. Salary from £300 with good prospects.
Apply, stating Age and full Details of Experience, &c., and enclosing photo, to No. 8022, "GAS JOURNAL," 11, BOLT COURT, FLEET STREET, E.C. 4.

LINCOLN CORPORATION.
(GAS UNDERTAKING.)

THE Corporation invite Applications from qualified persons for the Appointment of ENGINEER and MANAGER of their Gas Undertaking.
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A statement containing full particulars of the Terms, Conditions, and Duties of the Appointment will be sent on receipt of a stamped addressed foolscap envelope.
L. O. NEED,
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Guildhall,
Lincoln,
Jan. 9, 1930.

WANTED at once—Chemical Engineer with special Experience in the Practical side of Bye-Product Plant and Residual Plant for Gas Works and Coke Ovens. Must have Knowledge of Erection and Working of Plant and special Knowledge of Estimating and Design. Age must be between 25 and 40. There is good Scope for the right man.
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WANTED — An Experienced and Fully-Qualified REPRESENTATIVE for important district in South of England. Must have held a similar position, and have an established Connection with Gas Undertakings. Liberal Salary and Commission to first-class man.
Apply, stating Age, to THE PARKINSON STOVE COMPANY, LTD., STECHFORD, BIRMINGHAM.

DRAUGHTSMAN required immediately by Firm in Trafford Park, Manchester. Fully experienced in Gas-Works Plant.
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OWING to the Discontinuance of the Public Lighting, the Gas Committee of the Limerick Corporation have FOR SALE 650 GAS LAMP STANDARDS of various Designs and Dimensions, and OFFERS will be received for the above, for any quantity up to 650.
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Municipal Offices,
Plymouth,
Jan. 7, 1930.

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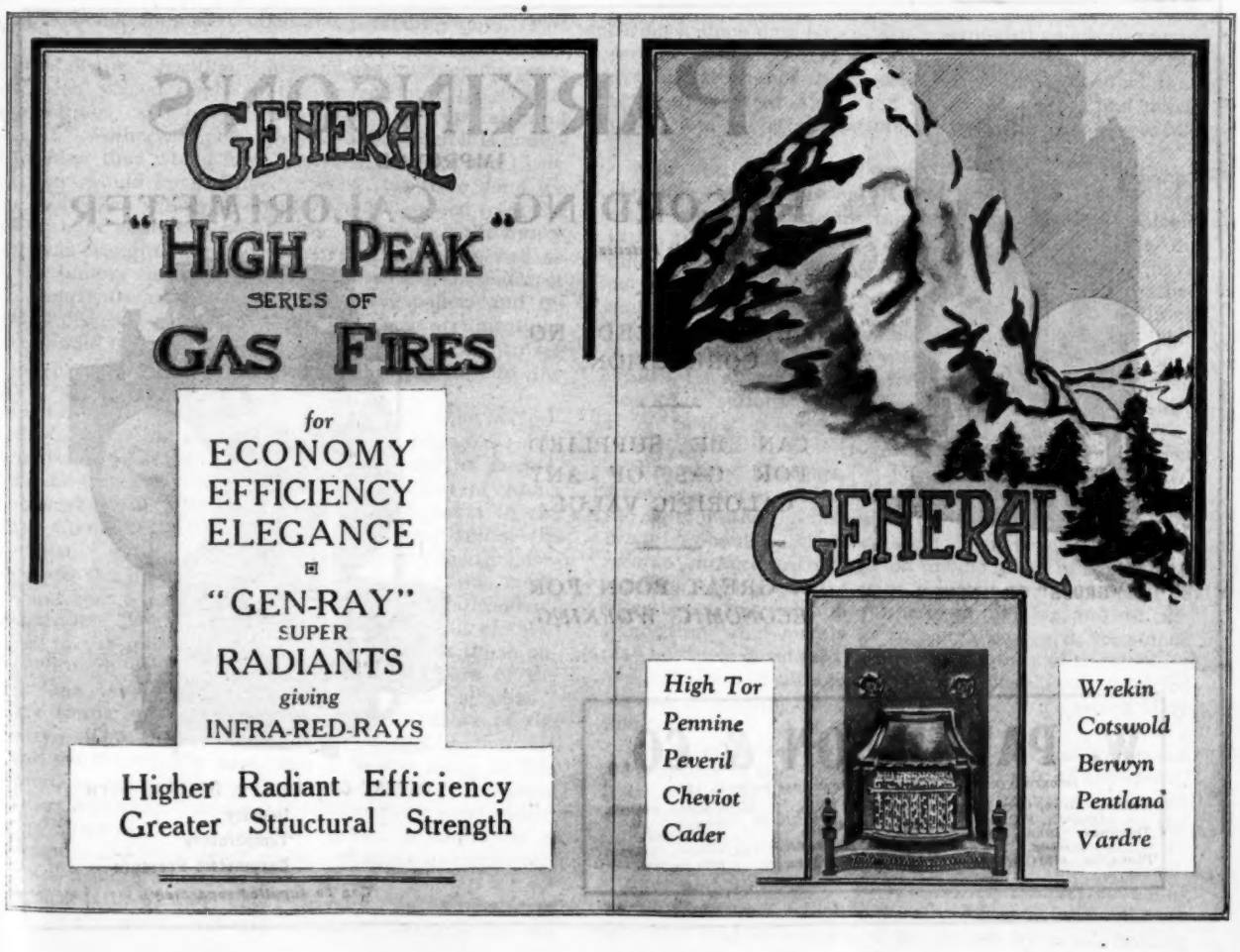

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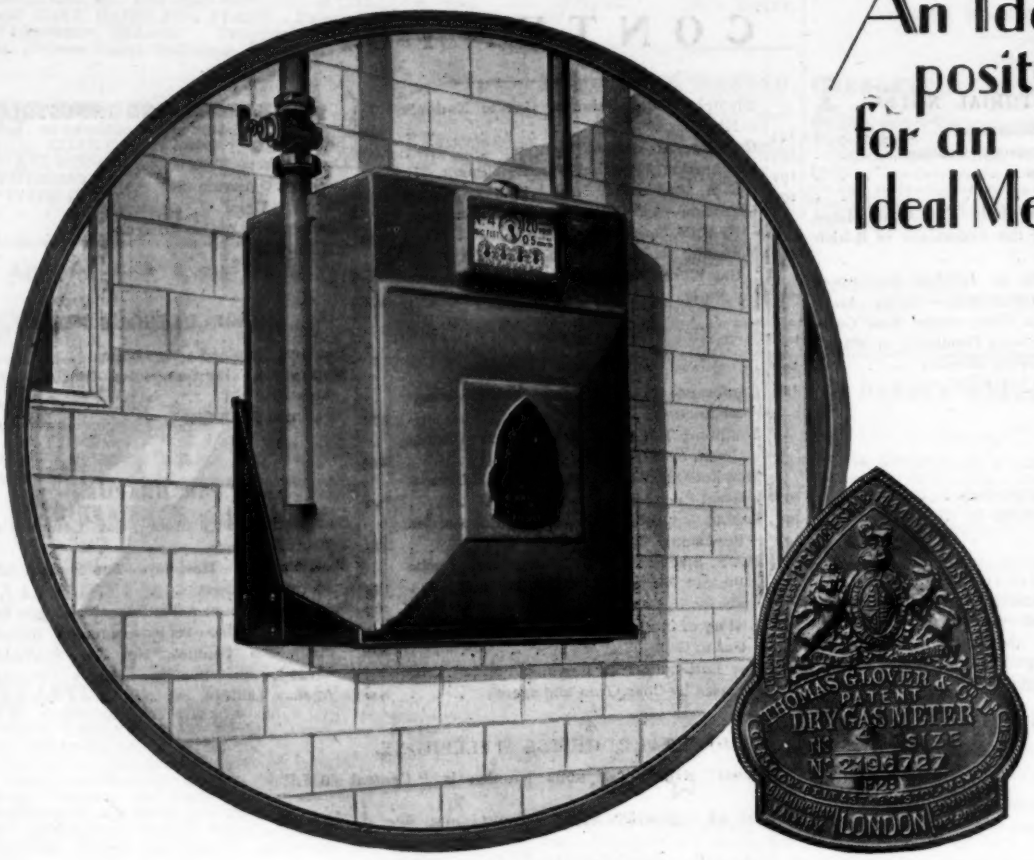

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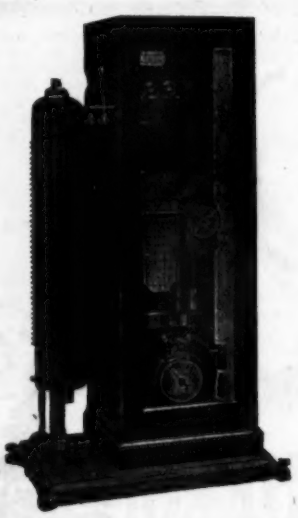

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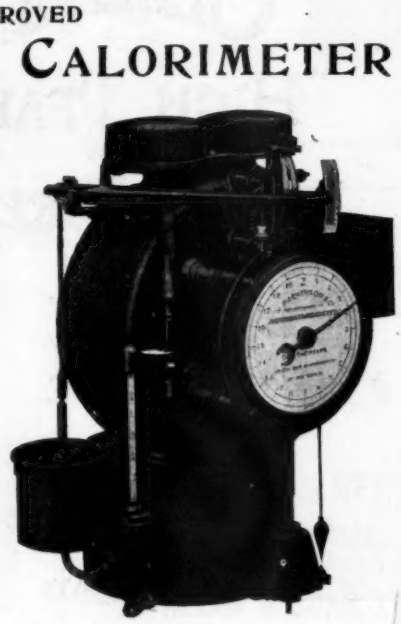

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